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SPECIAL ANNOUNCEMENT.

It is felt to be due to the many friends and readers of THE ELECTRICAL WORLD, who have taken a warm and hearty interest in its welfare and prosperity, from the small beginnings in 1874 down to the present time, that they should be advised of steps that have been taken to give the paper permanence as a useful institution and to enlarge the scope of its action and influence.

Desiring to make arrangements on a broader basis for the rapidly growing business, and to recognise at the same time the good and faithful work of the staff, the undersigned, heretofore sole proprietor, has organized the W. J. Johnston Company, Limited, to which the business has been transferred and by which all the new and old departments will be carried on.

The undersigned is president of the company, and will, as hitherto, have personal direction of affairs. Mr. Clarence E. Stump, the Business Manager, is Secretary and Treasurer of the Company; Mr. T. C. Martin and Mr. Joseph Wetzler have assumed the duties of Editors of the paper. No other titular changes have been made, and the staff remains the same at the New York, Boston, Chicago and Philadelphia offices, so that throughout its personnel the paper will still be represented by those who have been active in its management and upbuilding.

It is believed that this announcement of the formation of the company will be received with not less pleasure than is afforded in making it, and that it will be hailed as another proof of the steadfast intention to maintain and enhance the repute of THE ELECTRICAL WORLD as the exponent of electricity in America.

W. J. JOHNSTON.

Our Record for the Year. THE present issue of THE ELECTRICAL WORLD is the last of the year, and closes our Twelfth Volume. Looking back over the year we think we are justified in saying that during a period of remarkable activity, and development in unfamiliar directions, the paper has more than held its own, its growth being of the most vigorous and hopeful character. It has been the aim to improve and strengthen every department, and that an unusual measure of success has been attained must be apparent to all. During the year the paper has contained not far short of 1,300 illustrations, reaching its highest point to date in this respect. The two volumes of the year make up 708 reading pages, again beating the record as a whole, and as to individual issues; and the paper embraces everything that has been new and noteworthy in the science and application during the year. Moreover there have been such special efforts as the issuance of a chart of wire gauges, the commencement of THE ELECTRICAL WORLD portrait gallery, the employment of the submarine cable for early reports of scientific meetings abroad, and the publication of special supplements. In addition to this may be mentioned the regular directory of advertisers, which is now published every week, and which serves as a valuable classification of the different branches of manufacture and supply. The index for the two volumes, published with this issue, tells the story in brief, and is suggestive not only in regard to the comprehensiveness of the work, but the manner in which the newer industries are developing. At such a time and in view of the activity manifested all around in our chosen field, we are glad to wish our readers the compliments of the season and to predict for them a happy and prosperous New Year.

Telephone Rate Agitations. BOTH in St. Louis and in Chicago the telephone companies have scored a victory over the agitators who have been busily engaged trying to reduce rates. In St. Louis the city had passed an ordinance scaling down the rates, but the Supreme Court of Missouri has decided that the city possesses no such power. In Chicago, the result of the fight has been a compromise, in which the city agrees to accept the 3 per cent. of earnings tendered by the company. It will be seen that in both cases the contentions of the telephone companies have been found reasonable. Perhaps some of the disappointed agitators will now devote their energies to reducing the price of newspapers by city ordinance or fixing up revised schedules of admission to theatres.

A Meteorological Exhibition. FOLLOWING the practice of the Meteorological Society of Great Britain, the New England Meteorogical Society contemplates holding an exhibition of apparatus and photographs, and among these special attention will be given to appliances for the measurement and observation of atmospheric electricity and lightning. Such exhibitions go far towards collecting valuable material, secured in widely different parts by many observers; and their grouping under one head tends greatly to bring about uniformity of work, and the settlement of many questions involved in doubt. The photographs of lightning, among others, have in the past added much to the intelligent study of this natural phenomenon, and it is to be hoped that the appeal of the society for such photographs will meet with a hearty response.

New York's Electric Roads. AT last, it would seem, New York City is waking up to the fact that its claims as a centre of wealth and enterprise require it to have a few electric roads in operation. The recent performances on the Ninth avenue road, where the Daft motor hauled trains of eight cars, a thing, it is believed, never done before, have greatly aroused public interest and must have their fruit. New York is a city where electric locomotion has special advantages and recommendations, and it is a good sign, though tardy, that our citizens are aroused to the demands of the situation and the largeness of their opportunity. The present is a critical time in regard to our urban transportation facilities, and it is to be hoped that in the near new work electricity will be the only motive power employed. Nothing better than electricity could be asked for in such service.

Boston's Street Railways. WE publish this week an interesting article on the combined Sprague and Bentley-Knight electric railway plant that has been put in for Mr. H. M. Whitney, of Boston, on a portion of the West End system. It will be seen that the enterprise is one of no mean magnitude, and that its success will have an important bearing on the introduction of electric roads throughout New England. The service gives an exemplification of both the overhead and the conduit methods of operation, on the plans of two of the best known companies, and the results, whether comparative or direct, will be closely watched. As to the verdict of approval that will be given to electricity by the Boston public, we have not the slightest shadow of doubt, but we must confess to a little feeling of mortification that Boston should thus be ahead of New York in making this notable advance in street car work.

Electric Roads in California. MORE than once recently we have had occasion to comment on the activity that prevails in electric railroading in California, where so many favorable opportunities and conditions present themselves. That we are not alone in our views on this subject is evidenced by the noteworthy fact that Mr. C. B. Holmes, of Chicago, who has been *facile princeps* among practical cable men, and who knows all about horse roads also, has become financially interested in the Daft electric road at Los Angeles. While in that city effecting the purchase, Mr. Holmes stated that he had always been interested in electric roads and he believed in the future of electricity as a motive power for street lines. It is promised that under his management Los Angeles shall have the finest electric railway system in the United States, and when we remember what Mr. Holmes has done for horse and cable service in Chicago, it seems likely that even experienced electric railway men elsewhere will have to look to their laurels. We believe that out of his cable experience Mr. Holmes will be able to draw many ideas of improvement and perfection in motor service, and hence his adhesion to the electric railway cause must be regarded as a matter for universal congratulation.

Combining Large Interests. FOR some months past reports have been current in well informed electrical circles as to an intention to bring the various Edison lighting and manufacturing interests together in one large corporation and under one central management. It would be very difficult to keep such important plans wholly secret, and we need not be surprised therefore to see that the newspapers have devoted space to the matter, especially as the rumors connect with it so well-known a name as that of Mr. Henry Villard, and involve a capitalization of $12,000,000. It is not our intention just now to discuss the rumors referred to, as they will, in due time, we may safely assume, be given body and accuracy by those who are directly concerned, but we may seize the occasion to note the encouraging manner in which the press treat electric lighting interests, in this connection, as being just as solid as those of the railroads or the telegraphs. They evidently regard the affair as on a par with other notable negotiations in recent high finance, and are ready to consider such electrical securities as excellent property. It certainly was not always thus, and we are glad, for the sake of the whole electrical industry, to find the press evincing its appreciation of the extent and stability of this class of investments.

Primary Battery Construction. THE exact process by which electrolysis takes place has engaged the attention of scientists since the phenomenon itself was first observed, and various theories have been propounded. The "contact" theory, which first obtained considerable acceptance, has, by weight of evidence, been displaced by a more comprehensive one which involves the "traveling of the ions," and the labors of the Electrolysis Committee of the British Association have done much to increase the strength of that theory. What must be considered as a further strong proof is the work accomplished by Messrs. Roberts and Brevoort in the decided departure which they have taken in the construction of voltaic batteries. Based on the assumption that "contact" was not necessary to the destruction of a metal by an acid, they labored to discover a method by which the acid could be kept from direct contact with the metal and yet effect its decomposition under proper conditions—in this case, the closing of the circuit. This they have accomplished by the adoption of a partition which, while practically impervious to the passage of the acid, is yet of such a nature as to permit of the passage of the acid radical through it. The partition itself thus takes part in the electrolytic action, being decomposed and recomposed in the same manner as the remaining electrolyte, which, according to the theory now generally adopted, is acted upon in a similar way during electrolysis. This discovery must be considered one of the most important which has been made in this field for years. The results already obtained by the application of the discovery are said to be most gratifying, preventing as it does almost all local action, one of the principal sources of waste in batteries. It follows also that it permits of the use of materials heretofore deemed unsuitable. While the discovery of Messrs. Roberts and Brevoort may not realize the dream of those who expect to see the primary battery entirely displace the dynamo and steam engine, it cannot fail, it would appear, to add to the value of chemical sources of electricity.

A New Electric Meter.

Various forms of electric meters have been devised in which the current strength is measured by the attraction of a solenoid on a soft iron core; but in practice it is found that this attractive force is not proportional to the current strength, and hence errors arise. At the same time, meters of a certain class have been found to be sluggish in response to the action of a change of current, so that they do not immediately record a difference of current strength.

It is with the object of overcoming both these difficulties that Mr. Anthony Reckenzaun, of London, Eng., and Mr. James A. Pentz, of Philadelphia, have designed a form of meter, which is illustrated in two views in the accompanying illustrations.

As will be seen, it consists of a small electric motor *A*, connected in shunt to the main circuit, and which drives the worm *C* at a constant speed. This worm gears with the worm-wheel *D*, against which bears the friction wheel *E*, which is mounted on the brass tube *F*, the latter being free to move up or down on the spindle *G* to which it is feathered. A tube of soft iron *J* is attached to the brass tube, and under the influence of the current acts to draw the friction wheel away from the centre of the disc wheel *D*, and thus to increase the speed of the spindle *G*, the number of revolutions of which is recorded on a registering train *I* at the top. It will also be noted that the shaft *d* of the worm-wheel *D* has bearing against its end an arm *M*, the pressure of which keeps the worm wheel and friction roller in contact. On the bearing of the shaft *d* there is a cam *f*, and the shaft carries a pin *b* which bears against the cam once in every revolution. The result is that as often as the two come in contaot, the friction wheel is lifted clear of the disc *D* for an instant.

In order to avoid the irregularities due to the varying attractive force of a single solenoid, the inventors add a second one, shown at *K'*, having a core *J'*. The latter acts upon the friction wheel *E* through the lever *S* and assists the action of the solenoid *K'*, thus keeping the movement of the friction wheel proportional to the current strength.

The operation of the instrument will now be readily understood. As soon as the current is switched on, the constant speed motor *A* will revolve. If no current is required by the main circuit, the motor *A* will only consume a very small fraction of energy necessary for its own propulsion, and the friction-roller *E* will be in the centre of worm-wheel *D*, its normal position. When the flow of current is caused by electric lamps or other energy-consuming apparatus being put in action, the core *J* will be sucked up into the solenoid *K*, and simultaneously the friction-roller *E* will be raised out of the centre of the worm-wheel *D*, which keeps on revolving and causes the roller *E* to revolve with it. The greater the current in the solenoid *K* the further will the core be

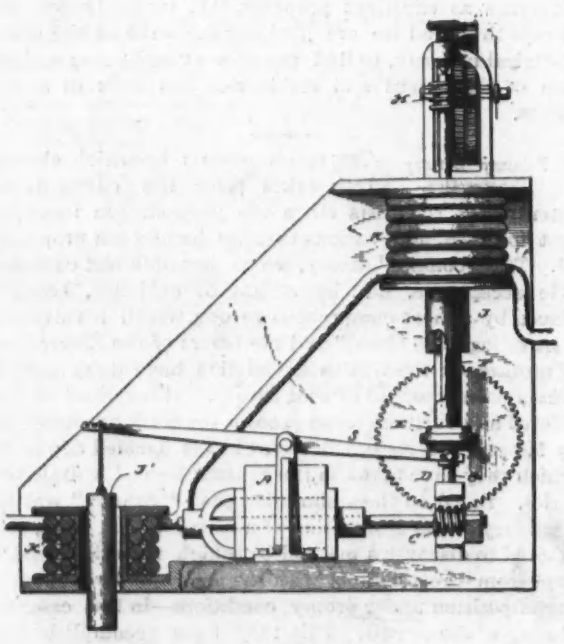


FIG. 1.—RECKENZAUN AND PENTZ'S ELECTRIC METER.

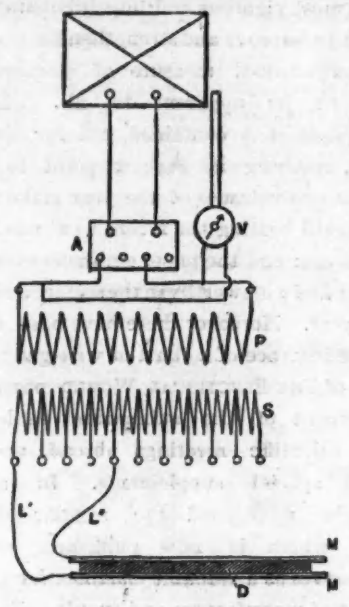
sucked into it and the friction-roller *E* be moved away from the centre of the worm-wheel *D*. The influence of the solenoid *K'*, however, on its core *J'* compensates the varying attractive force of the solenoid *K* on its core *J*, as the latter changes its position in its solenoid, and so an equilibrium is established between the two ends of the lever and the proper position of the friction-roller determined.

The speed of worm *C* being constant, the revolutions of friction-roller *E* and spindle *G* will be in proportion to the radial displacement of the wheel or roller *E*. Consequently the more energy there is consumed the faster will roller *E* and everything attached to it run, so that there is formed a variable speed-gear; and as often as the worm-wheel is moved away from the friction-roller by the cam acting on the pin *g* the friction-roller is given an opportunity to drop in proportion to the reduction in the energy consumed, and thus caused to assume its proper position for the energy consumed. The worm-wheel *I* drives a set of wheels provided with pointers which indicate the number of revolutions made by the spindle *G*.

A 10,000 Volt Testing Transformer.

The usual tests of insulation consisting only of a measurement of the insulation resistance afford very little guarantee, especially in the case of electric light cables, for the working strength of the insulation, seeing that the test is usually made by means of laboratory batteries having a comparatively low E. M. F.

At the Menier Electric Cable Works in Paris-Grenelle, an alternating current transformer, made by Messrs.



10,000 VOLT TESTING TRANSFORMER.

Ganz & Co., of Budapest, has been used since March, 1888, for the purpose of testing cable insulation as well as any dielectric. This transformer is constructed with a primary coil *P* for 100 volts and 70 ampères, and a secondary *S* for 10,000 volts and 0.07 ampères, the ratio of transformation being 1 : 100.

The secondary coil is divided into 10 divisions, the ends of which are led to metal contact pieces with conical holes. By means of two plugs and two flexible leads *L' L''*, the dielectric to be tested can be subjected to a difference of potential of from 1,000 up to 10,000 volts, and its behavior observed.

In the primary circuit there is, as well as the generator, a double pole switch *A*, in order to cut off the primary circuit entirely before altering the secondary difference of potential by shifting plugs. A Cardew voltmeter indicates for the control of the primary potential.

Concerning the construction of the transformer, it may be mentioned that the primary and secondary coils, as well as the divisions of the secondary, are carefully insulated from one another with ebonite. The metal pieces forming the terminals of the secondary divisions are mounted on high ebonite supports, the metal plugs being also furnished with long handles of the same material.

The transformer, together with the terminals, is mounted on a strong base board, on which there is also a double pole switch with porcelain base and handle.

This method of testing the insulation of cables affords a far better guarantee for their safe working in actual use than that of testing by measuring the insulation resistance with a comparatively low E. M. F.

Electric Lighting of Residences.

BY S. MARSH YOUNG.

The electric lighting of houses distant from a central lighting station has, heretofore, to a certain extent been an impossibility, owing chiefly to the fact that a steam plant has been necessary, and that in the production of electric light direct from a dynamo it has been impossible to obtain light except when the dynamo is running. The operation of a steam engine necessitates the presence of an experienced engineer, which immediately makes its production so expensive as to be beyond the reach of any but the more wealthy. The time when light is most required in a private house is between the hours of six and ten or twelve o'clock at night, when it is almost impossible to obtain the services of a competent engineer. The noises and vibrations attending the operation of a steam engine have been another drawback to its introduction, for few are willing to have machinery in operation in a private house until after the hour of midnight or during the time when light is required. There has been no means of producing electric light with the direct lighting method so that light may be available at all times except by the running of a dynamo continuously, and unless light can be available at all times it fails to compete with gas, and, therefore, cannot find its way to one place that it will be most appreciated in,—our homes. The storage battery, however, seems to overcome all these difficulties, and to solve the problem of incandescent lighting in insolated cases.

In the course of some remarks recently made before an electric light association by a prominent New York electrical engineer, the importance of storage batteries in electric lighting was very clearly shown in the following: "I would call the attention of the members, for instance, to the lighting of private residences which are detached, country residences, summer residences, and large mansions. I believe that here the storage battery has a sphere which it will hold as its own, for the reason that the direct system of lighting of to-day does not afford all the requisites of a perfect application of electricity for lighting. It has not supplanted gas, and you will find that wherever isolated plants are in use to-day they still have gas. Now, I do not consider that we can look upon isolated lighting as a success until we see it drive gas out altogether. To do that we must have electricity "on tap" for twenty-four hours a day, the same as gas, and I can conceive of no system by which this can be done successfully except one involving the use of storage batteries as an accessory, if nothing more."

A storage battery can be charged with the use of almost any form of power during the hours of the day, and in many instances energy now running to waste may be utilized in laying up a supply for night use.

One of the interesting developments in this connection is the prominence of the gas engine as a producer of electric light. This power seems to be particularly fitted for work in connection with storage batteries. The operation of these engines is so simple that they can be cared for and run by the employés of almost any house. The power is always available. The gas in the engine is ignited by a spark from the battery, and, in fact, can be started by simply turning a battery switch, using the dynamo for a moment as a motor to bring the engine up to speed. Thus by the simple operating of a switch the entire plant is set in motion. The battery is charged during the day, and at night when the engine is shut down, enough energy will have been stored to supply the house with light for the entire night.

The engraving on page 339 represents one of the mos interesting displays at the American Institute Fair this season, the installation of the Julien Electric Company, showing the application of storage batteries to the lighting of private residences in connection with a Baldwin gas engine and a United States dynamo. The plant consisted of a 4 h. p. gas engine coupled to a 30-light dynamo and 36 cells of Julien battery. There were in the exhibit some 95 16 candle-power lamps, in addition to two ¼ h. p. electric motors used for operating a fan and sewing machine, another application to family needs. The current from the battery can also be used for pumping water, the running of electric bells, burglar alarms and other light work. The dynamo charges the battery during the day and at night when the full number of lights is turned on, the dynamo takes care of 30 lights, and the remaining 65 are taken from the accumulators. It will thus be seen that in addition to serving as a reservoir to be called on when the

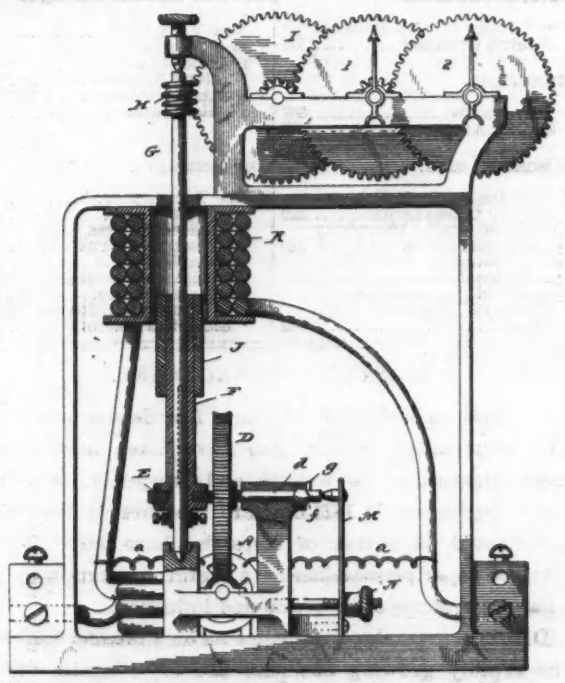
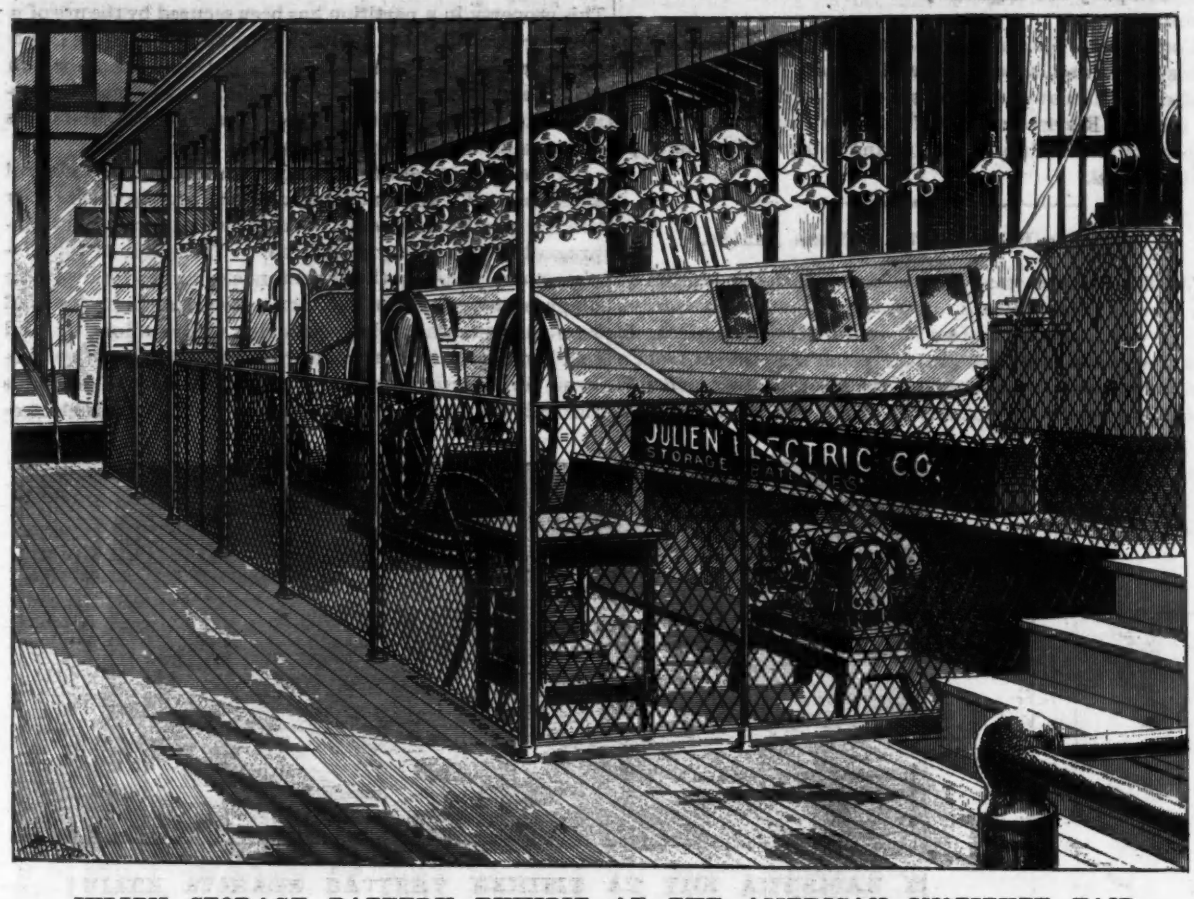


FIG. 2.—RECKENZAUN AND PENTZ'S ELECTRIC METER.

plant is not in operation, by the running of the dynamo, and at the same time discharging from the battery, a largely increased number of lamps is available, thus reducing very considerably the amount of power necessary to be introduced. It is generally acknowledged that light derived from storage batteries is of greater steadiness than that produced direct, thus increasing considerably the life of the lamps.

The cell employed was the Type 19 C. of the Julien Company, weighing complete about 44 pounds, which is rated by that company as having a capacity of 200 ampère-hours, and the rate of discharge given is 30 ampères. It will be seen, however, that, as these lamps take about $\frac{3}{10}$ of an ampère each, the batteries were being discharged at about twice their normal rate, and where occasion required the engine was stopped and the batteries supplied current for the entire plant, thus discharging at almost three times their

nominal rate. This is a particularly creditable showing for these batteries. The principal difficulty heretofore in the use of accumulators has been that they have not been permitted to be discharged at a greater rate than from about one-tenth to one-eighth of their capacity, whereas in this exhibit they were regularly required to deliver their full capacity in about four hours. The cells were in use from the commencement of the exhi-



JULIEN STORAGE BATTERY EXHIBIT AT THE AMERICAN INSTITUTE FAIR.

bition, the 1st of October, until December 15, and did not in that time require the least attention on the part of the company, the plant being run entirely by a man in charge of the gas engines, who, until the opening of the Fair, had never been in charge of an accumulator plant.

The lights were burned four hours each night, which, discharging at the rate of about 60 ampères, and occasionally at 80 to 85, made a total of 250 ampère hours taken out, while the rated capacity (discharging at the nominal rate) is but 200 ampère hours. This is an indication of the large amount of reserve energy there is always on hand in case of an accident or stoppage of the generating plant or in case of an emergency,

The storage battery is also useful in connection with the lighting of detached buildings when charged from an arc current of high potential. In many cases it is not possible to run an incandescent circuit from a lighting station owing to the cost of mains for currents of low tension. The battery is placed on the arc main, and in series with an arc lamp. The lights are then taken from the battery at a low voltage.

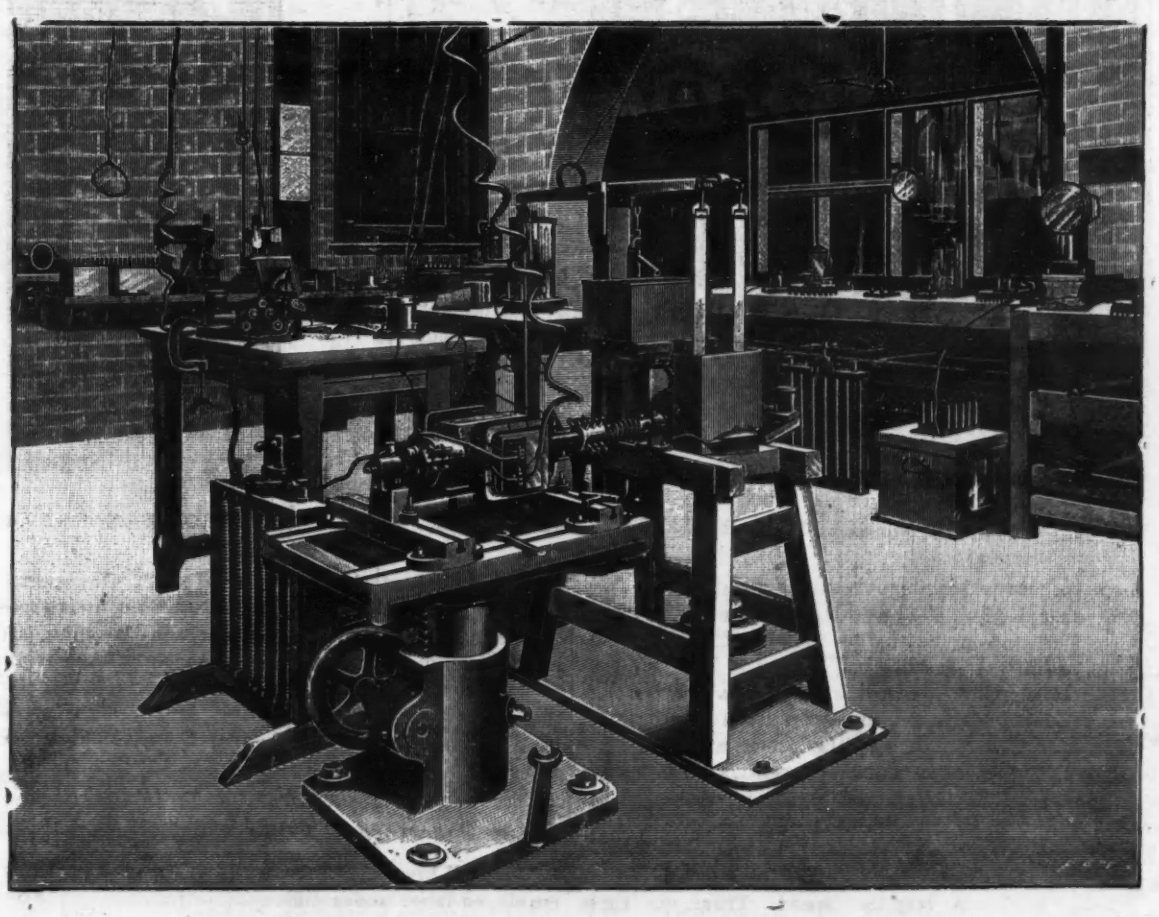
This battery is the same as is now being successfully employed in the propulsion of street cars on the Fourth avenue road in this city, and elsewhere.

A Testing Room for Electric Motors.

In a series of interesting articles on the course of study pursued at the Central Institution of the City and Guilds of London Technical Institute, Mr. G. W. de Tunzelmann describes in *Engineering* the arrangement of the room for testing electric motors, which is illustrated in the accompanying engraving.

This room is separated from the dynamo room by windows of double glass, so that, while the interior of the dynamo room can be clearly seen from the room illustrated much of the noise of the moving machinery is cut off. Wires come from the switch-box in the adjoining room to the table under the window to the right and to the table of which a portion is seen still further to the right of the illustration. On these tables are a number of commercial measuring instruments, by means of which complete electrical tests can be made of any one of the dynamos, the speed of which is indicated at any moment by the water manometer seen standing up at the back of this illustration. Pitch-lined wooden troughs under these tables contain a number of platinoid wires in running water, so that large currents can be sent through the wires without heating them, and switches with many contact pieces, seen on the tables to the right, enable any resistance to be at once put in the circuit of any dynamo. Additional resistances, capable of carrying large currents, are sometimes required for special experiments, and such adjustable resistances are seen on the floor to the right.

To the front of the illustration is seen the complete arangement for testing the power and efficiency of an electric motor. The motor is geared to a Raffard compensating absorption dynamometer, which has had several small improvements made in it since it was received at the Central Institution; among others a pump has been added to facilitate the lubricating arrangements, and the Hooke's joint coupling supplied with this dynamometer has been replaced by a simple spiral spring, which is found to introduce much less friction when the axes of rotation of the motor and of the dynamometer are not quite central. Whatever the size of the motor its axis of rotation is brought to the right height by the metal table carrying the motor being adjustable vertically, and further by means of the clamping arrangements any sized motor within certain limits can be fastened to this metal table.



MOTOR TESTING ROOM. CEN RAL INSTITUTION, LONDON.

The speed of rotation is shown at any moment by a centrif ugal speed indicator connected by a fine spiral spring to the farther end of the dynamometer shaft. This dynamometer may be driven from either end of the shaft, and in the case of a motor which rotates counter-clockwise when looked at from the brush holder, the small holding down bolts at the base of the dynamometer are removed, and the dynamometer baseplate rotated on a pin (which is vertically under the centre of the dynamometer shaft) so that the ends of the dynamometer shaft are interchanged relatively to the motor.

Current is brought to the motor by means of the two thick flexible wires, a magnifying spring ammeter and an adjustable resistance being in the circuit. These wires go to the main switch-board, so that constant potential difference can be maintained at the terminals of the motor or constant current sent through it, or any desired supply conditions such as occur in practice produced. Two finer wires go from the motor to a magnifying spring voltmeter standing to the right on the centre table for measuring the potential difference. There is, therefore, complete apparatus for measuring the power given electrically to the motor, as well as the power given out mechanically by the motor, and in consequence of the Raffard dynamometer automatically adjusting the amount of belt wrapped on the running pulley as the coefficient of friction varies, the load on the motor can be kept constant for any length of time. Or instead of making these electrical and mechanical measurements with a motor as well as measuring by means of the transmission dynamometer in the adjoining room, the power given mechanically to a dynamo, and, by means of the electric instruments, the power given out electrically by the dynamo, all electrical measurements may be dispensed with, and instead merely a comparison made of the power given out mechanically by the motor, and the power given mechanically to the dynamo. From this comparison the efficiency of the complete electric transmission of power is at once obtained. Arrangements also exist in the dynamo room for enabling the students to make efficiency experiments by coupling two dynamos mechanically together, one of them acting as a dynamo and supplying electric power to the second, which acts as an electric-moter and helps to drive the first, the additional power required to make up the loss being either supplied mechanically and measured with a transmission dynamometer, or supplied and measured electrically.

For investigations requiring still greater accuracy than is obtainable with commercial measuring instruments, low and high resistance reflecting d'Arsonval galvanometers, standing on the brackets carried from the wall to the left, are employed. The low resistance galvanometer is actually used to measure the potential difference at the terminals of a large sheet of platinoid, through which the current to be measured is passed, and so, indirectly, the current passing through the sheet is measured. For currents up to 100 ampères the sheet seen suspended on the wall to the left of the illustration is employed, while for greater currents a sheet of platinoid immersed in running water is used. By varying the resistance in the galvanometer circuit a wide range of sensibility is obtained, so that while, with no extra resistance in the galvanometer circuit, a current of only 1 ampère gives a deflection of 200 scale divisions, with a resistance of 1,600 ohms in the galvanometer circuit currents up to 2,000 ampères can be accurately measured. Hence with the same galvanometer currents varying from 1 up to 2,000 ampères can be measured with considerable accuracy; whereas if the whole current were passed through the instrument a whole series of galvanometers would have to be employed to measure the same range of current with the same degree of accuracy. The d'Arsonval galvanometers in this and the other laboratories are periodically calibrated with the silver voltameter for small currents, and with a very large copper voltameter for large currents.

The completeness of the fittings of the various electrical laboratories may be gathered from the fact that they contain in daily use over twenty-five galvanometers, including ammeters and voltmeters of various types and degrees

of sensibility, some twenty-six resistance boxes, five electrometers, not counting mere electroscopes, six complete Wheatstone bridges, some eight or ten condensers varying from one-third of a microfarad to 20 microfarads capacity each, etc.

During the second year's course the details of construction of the best forms of dynamos and motors are gone into very fully, and the instruction given is of such a nature as to enable students to determine for themselves the forms of dynamos and motors best suited to obtain any given results and to lead them up to designing improvements in existing machines. They become familiar with the best forms of electic-motors and with the defects most commonly met with in motors now in use. Accumulators are studied in considerable detail, and a long series of experimental determinations of the coefficients of self and mutual induction are made by various methods.

The Danville, Va., Electric Railway.

Some time since the officers of the Danville Street Car Company came to the conclusion that the mule was not a success for their work, and that it would be better to adopt electricity for their road, which then consisted of seven "bobtail" cars, each drawn by mules and driven by one man. After looking over the field thoroughly they decided to employ the Thomson-Houston system. A contract was therefore given to the Thomson-Houston Company and work was soon begun.

The entire length of the road is a little over two miles, and for 4,150 feet of this distance the ascent averages 4.3 per cent.; for 2,100 feet of this the ascent averages 5 per cent.; for 1,000 feet the ascent is 7 per cent., and for a short distance of this 1,000 feet stretch the grade exceeds 7 per cent.

Up these grades, which the electric car surmounts with ease, it was with difficulty that four mules could haul an ordinary load at a very low speed. There are three diamond pointed turnouts with the necessary overhead frogs, owing to the fact that the track is single the entire length.

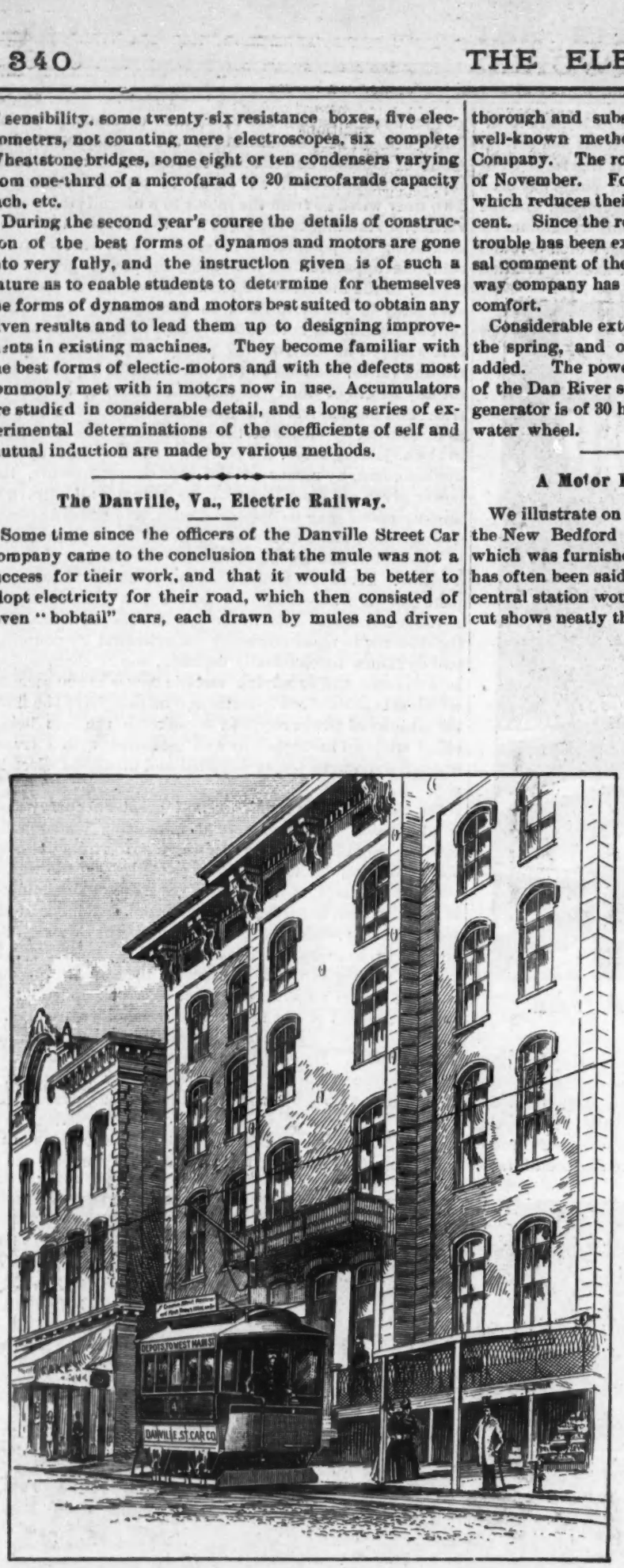
One noticeable feature which the road brings out is that it is perfectly practicable to have a car operated by one man, even though there are a number of switches in the line. It is not in every case the wisest or best plan to pursue, but in some localities it may be the only one possible. It is a noteworthy fact that one man easily handles a car, and this is due to the admirable perfection to which the overhead switches and the trolley wheel have been carried out. No trouble whatever is experienced, although the driver rarely gives the overhead matters any attention.

The cars were equipped with motor trucks of 10 h. p. capacity, the controlling mechanism being concentrated at one end. The overhead system was built in the most thorough and substantial manner, and according to the well-known method of the Thomson-Houston Electric Company. The road was started in operation on the 20th of November. Four cars are daily run on a trip basis which reduces their former mule schedule nearly 25 per cent. Since the road was started scarcely any electrical trouble has been experienced, and it has been the universal comment of the residents of Danvillle that their railway company has materially added to their welfare and comfort.

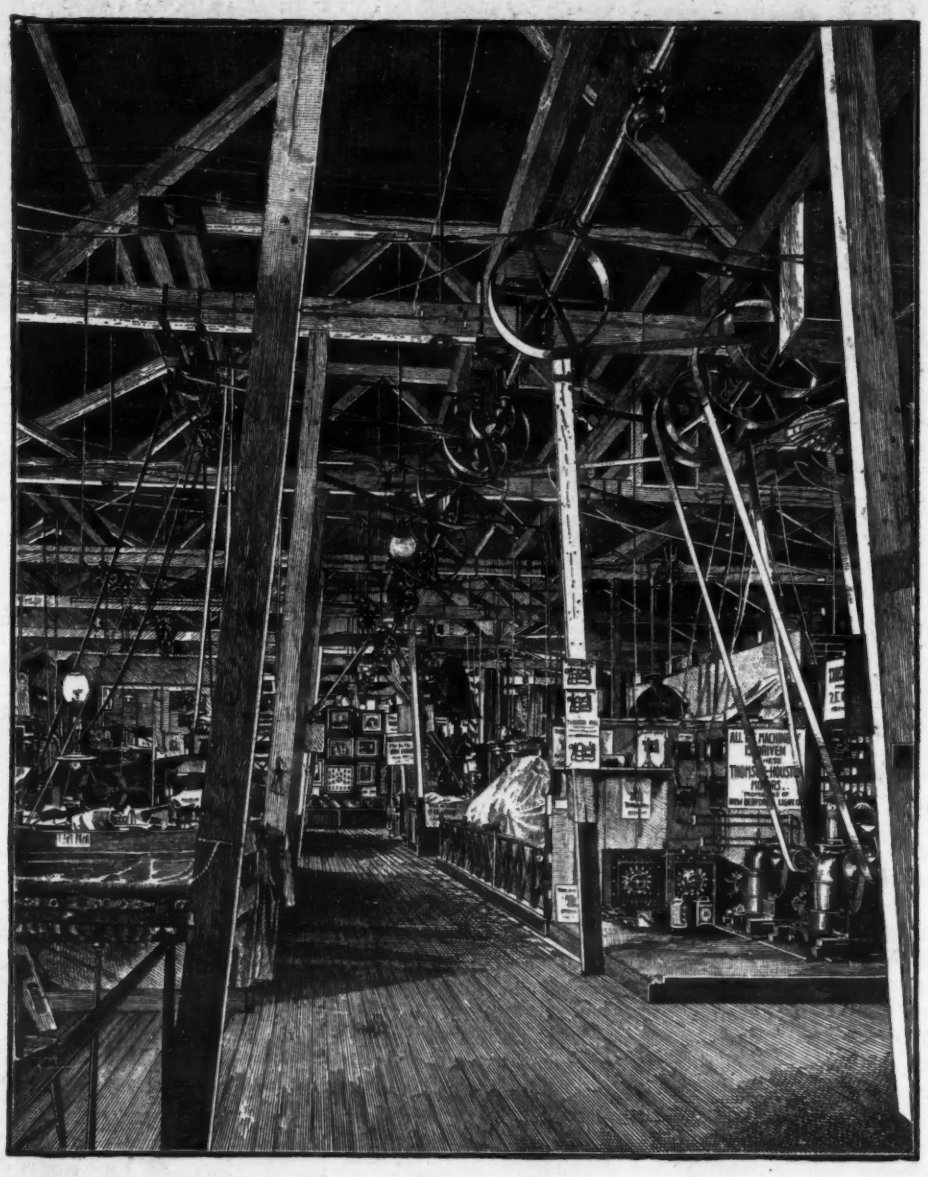
Considerable extensions are contemplated on this line in the spring, and other cars will, in all probability, be added. The power station is located on the opposite side of the Dan River some 2,000 feet away from the line. The generator is of 30 h. p. capacity, and is driven by a 75 h. p. water wheel.

A Motor Preferred to a Steam Engine.

We illustrate on this page a part of the exposition of the New Bedford Board of Trade, the entire power for which was furnished by two Thomson Houston motors. It has often been said that a motor receiving current from a central station would supplant the steam engine, and this cut shows neatly the manner in which the revolution, for it is nothing short of this, can be effected. One special advantage in an installation of this kind is the utter freedom of the motor from all such nuisances as heat, noise, dust and dirt, all of which have so much weight in determining the position of a steam engine. Another material point is that the setting up and removing of a temporary motor plant are much easier and cheaper than installing a boiler and engine.



THOMSON-HOUSTON ELECTRIC RAILWAY, DANVILLE, VA.



THOMSON-HOUSTON MOTOR AT NEW BEDFORD, MASS., EXHIBITION.

A New Departure in Primary Battery Construction.

It is well known that batteries in which two fluids are employed labor under difficulties introduced by the porous cup usually employed. The cup is resorted to for the purpose of separating the two liquids, while affording a passage for the current and a path for the electrolytic action. If the cup be made too porous the liquids will diffuse too easily and cause wasteful local action; while if it be made but slightly porous to prevent this very diffusion, the internal resistance of the cup and battery will become very great, and thus reduce its efficiency. In order to overcome these difficulties Mr. I. L. Roberts and Mr. Henry L. Brevoort, of the Roberts-Brevoort Electric Company, of this city, have for some time past been engaged on a series of experiments the results of which are embodied in the battery now made by that company, and the nature of which calls for some notice.

Messrs. Roberts and Brevoort, recognizing the troubles and problems above mentioned, started out to make the partition separating the two liquids in a battery of a material which should practically be non-porous, but with electrolytic properties, so that whether the battery be on an open circuit or closed, the liquid, as such, on one side of the partition would not intermix or intermingle with the liquid on the other side of the partition, or only to a very limited extent; but when the circuit is closed and the battery is called upon to give a current of electricity, chemical action could take place through the partition. This property in a partition has been secured by the use of a number of materials. Among those first tried were gelatinous or jelly-like materials, such as boiled starch which was confined between walls of cloth, so as to make a suitable diaphragm; and other vegetable and animal substances of a similar nature have been used.

In the more recent forms the inventors employ mineral substances of a gelatinous nature, and among others they use the gelatinous silicate of soda, with which they impregnate the ordinary porous cup. The action of this diaphragm or partition the inventors explain as follows: The diaphragm or partition is a non-porous substantially solid homogeneous wall, whose particles, while sufficiently solid and compact to maintain their own positions and so prevent for practical purposes any transmission of fluids through them, are yet themselves able to act as electrolytes and suffer such decompositions and recombinations as are essential to the electrolytic transmission of electric force. In other words, they have in the partition combined in the one substance the solid properties of the earthenware and the electrolytic properties of the liquid, or as they say, they have made the electrolytes solid and the partition electrolytic.

The results obtained by the use of this non-porous partition are reported to be highly satisfactory, so that very nearly the entire theoretical amount of energy contained in the zinc is obtained as current in the external circuit, due to the absence of local action even when the cell remains idle for long periods of time.

Effects of Static Electricity and Lightning on the Body.

Dr. Rojdestvenski, of St. Petersburg, who has been carrying out a series of observations on the effects of static electricity on animals, finds that the death is, usually at least, due to the action on the cardiac muscle. In cases of death from lightning it is by no means always possible to demonstrate the existence of morbid changes in the nervous tissues. During the experiments with static electricity it was found that the greatest effects were produced when the animal was insulated. As to the electrolytic, or chemical effects, Dr. Rojdestvenski regards them as having little, if any, relation to the fatal results.

The Sprague (West End) Electric Road, Boston.

For some time past electrical engineers interested in street railway matters have been awaiting a report on the preliminary trials of the new Sprague road put in between Boston and the suburb of Brookline, a distance of several miles. We are enabled this week, through the courtesy of the Sprague Company, to present some details and illustrations.

The West End Street Railway, of Boston, of which the road is a part, is the largest street railway in the world; it extends over 212 miles of track, using 1,700 cars and more than 9,000 horses. The president of the West End Street Railway Company, Mr. Henry M. Whitney, of Boston, is universally recognized as one of the most enterprising and successful street railway men in the country, and, aided by an efficient corps of assistants, he has succeeded in giving Boston the most efficient street railway service that ever existed there. Before deciding upon the electric system to be adopted upon the West End road or awarding the contract, President Whitney, accompanied by members of the board of directors and managers, visited all the principal electric railways in the country, and made trips upon three different occasions to Richmond, Va., to inspect the road in operation there upon the Sprague system.

The system of electric railway called for in this contract is wide and comprehensive. The main line from Boston westward, beginning at Park Square, will run down Boylston street bridge, and then down Chester Park to Beacon street. It will then proceed over the Beacon street extension, Figs. 1 and 3, to the Chestnut Hill reservoir, and to Allston and Oak Square, Brighton. From the East Park gate over the new boulevard to the Chestnut Hill reservoir and Brighton the Sprague overhead system will be adopted. In the more crowded streets of the city the Bentley-Knight conduit will be used, and the Sprague cars will run over the whole system.

FIG. 1.—VIEW ON BEACON STREET, BOSTON.

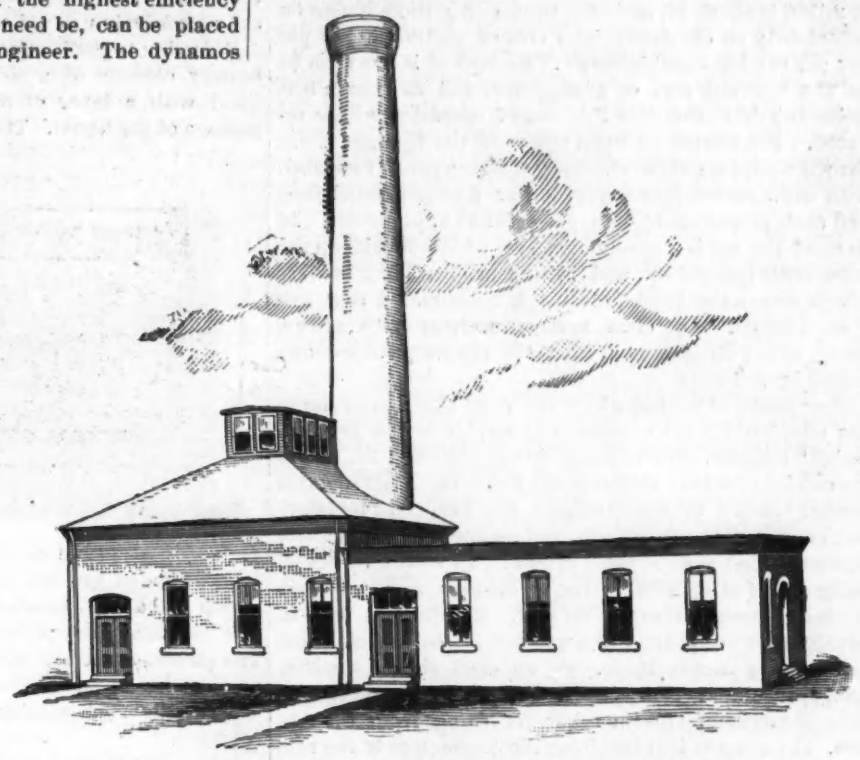


FIG. 2.—SPRAGUE POWER HOUSE AT ALLSTON.

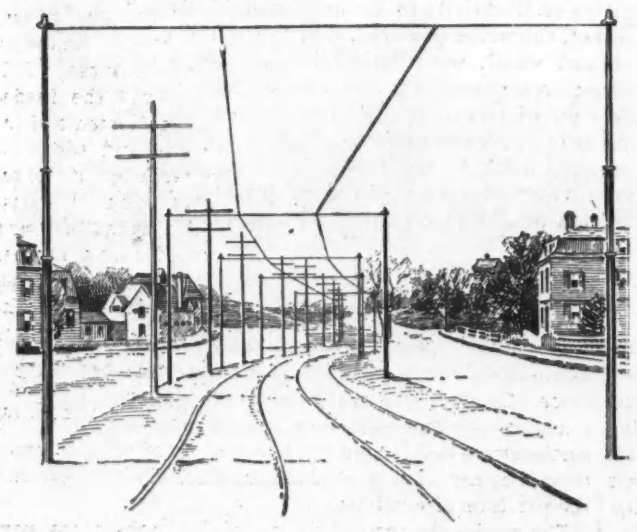
The power station, Fig. 2, from which the electric current is distributed to the line, is situated on Braintree street, Allston, near the Boston & Albany Railroad, and also at the edge of the water, thus giving both water and rail facilities for fuel. This plant, which is one of the best of its kind in the country, is situated very nearly equidistant from the extremities, and is, therefore, literally a central station. The station, with the adjoining car-house, is of brick and completely fire-proof. In its construction it was the aim of the West End Company to get the best in every detail. The chimney stack is 100 feet high. The boiler-house, which is both convenient and commodious, is at present equipped with three horizontal tubular boilers, furnished by the Jarvis Engineering Company. The engine room contains two high-speed automatic cut-off engines of the Armington & Sims pattern, of 200 h. p. each. Each drives two powerful Edison dynamos of 80,000 watts each, and wound for a maximum pressure of 500 volts. These dynamos are of the highest efficiency and simplest construction, and, if need be, can be placed under the charge of the steam engineer. The dynamos feed into copper bus wires, supported on the walls by porcelain insulators.

Each machine has its independent ampèremeter, and in addition there is a general ampèremeter at the end of the positive bus bar. From this bar the current passes to special snap switches, each switch being connected through a three-plug safety switch back to one of the feeders supplying current to the main line wire. These feeder wires tap into the line wire at different points on the line of road, thus maintaining the pressure approximately equal all along the line. At the ends of the feeders in the central station, pressure indicators are attached, which indicate the voltage at the junctions of the feeders with the main current wire.

The engine-room is brilliantly lighted by handsome hanging electroliers, each of which have five incandescent lamps. A switch-board at one end of the room furnishes an independent control for each group of lamps. All the surroundings of the machines are kept in the neatest condition. Adjoining the power house, but separated by thick brick walls, is a commodious house for accommodation of cars, 107 feet long by 80 feet deep, designed to hold 24 cars.

The fine overhead system, see Figs. 3 and 4, includes iron poles set in concrete throughout the entire length of the road. These poles are of a very neat and tasteful pattern, and support the span wires which carry the trolley wire at a height of eighteen feet over the centre of the track. This overhead wire, which is used for a working conductor, is made of silicon bronze of the small Sprague type, only $\frac{1}{10}$ of an inch in diameter. This is the only wire suspended over the middle of the track, and its lightness and high tensile strength allow the overhead supporting structure to be of the lightest description possible. The poles are 125 feet apart.

The return circuit is through the rail, and thence by both metallic and ground circuits to the station. Each section of rail is joined to copper ground wires throughout the length of the road underneath the string pieces. At intervals of 500 feet this ground wire is connected to an earth plate, and at seven points widely distributed the ground wire is connected to the station, and there is also a main ground connection made there through a large earth-plate. In the overhead system a new method of switching has been adopted which is at once ingenious and simple. Five or six feet inside the turnouts a small switch with flaring rider is interpolated into the main and branch wires, and a spring tongue upon this directs the path of the "trolley" with absolute certainty and ease. By this means switching is made very easy, and all danger of the trolley leaving the wire is obviated.



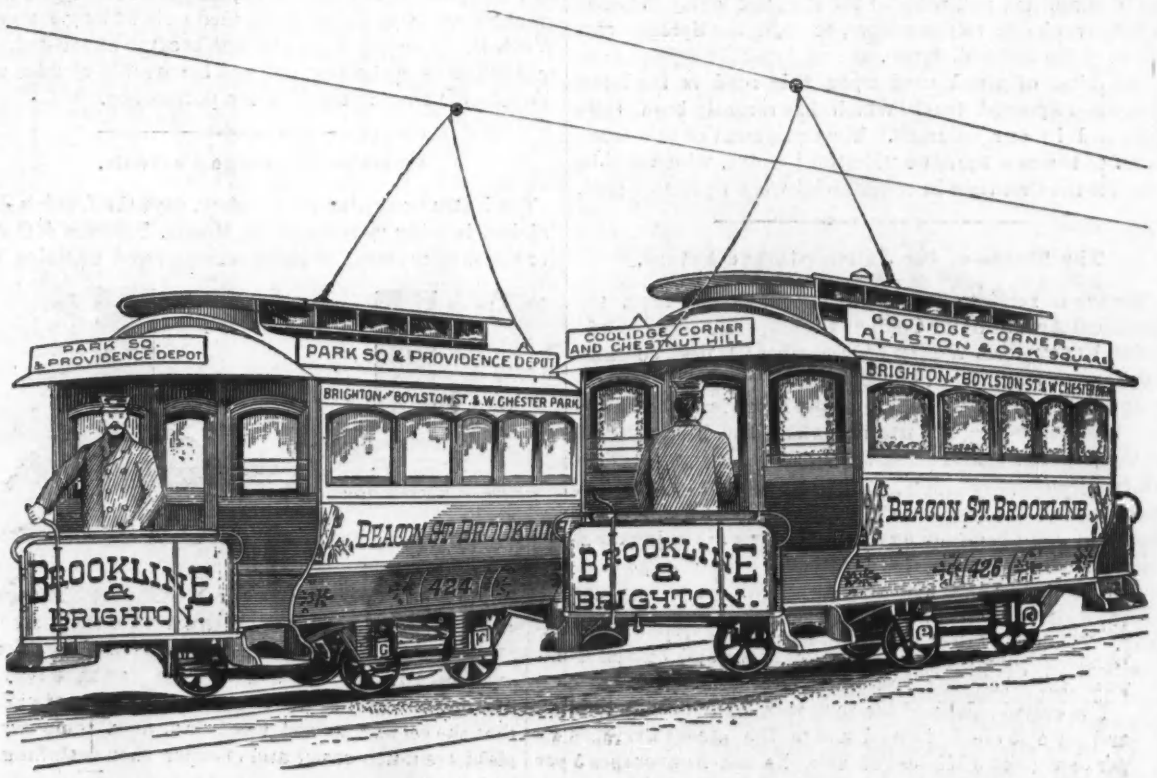

PARK SQ. & PROVIDENCE DEPOT
PARK SQ & PROVIDENCE DEPOT
BRIGHTON & BOYLSTON ST. & W. CHESTER PARK
BEACON ST. BROOKLINE
BROOKLINE & BRIGHTON.
424
COOLIDGE CORNER AND CHESTNUT HILL
COOLIDGE CORNER. ALLSTON & OAK SQUARE
BRIGHTON & BOYLSTON ST. & W. CHESTER PARK
BEACON ST. BROOKLINE
BROOKLINE & BRIGHTON.
426

FIG. 3 AND 4.—VIEWS OF SPRAGUE ELECTRIC RAILWAY, WEST END, BOSTON.

The cars, Fig. 4, can be run at widely different speeds, varying from the slowest crawl to 12 or more miles per hour. They can be started and stopped without the use of brakes in the space of 3 or 4 inches, and when making the normal running speed can, in an emergency, be stopped and reversed without brakes within less than one-quarter of a car length. This is especially advantageous in crowded thoroughfares, and shows the superiority of the electrical car over the horse or cable cars. The control over the car seems marvelous, for one notes little or nothing save a slight movement of the hand of the motor-man; and the starting, although prompt, is very gradual and without shock or jar. The ordinary driver can operate one of these cars without the slightest trouble, after a very

brief instruction. The saving on the operating cost of the Sprague system, owing to the superior quality of the apparatus over an ordinary horse-car line, constitutes a no inconsiderable item. It has been found that the average cost of motive power per car a day throughout the United States, that is, for from 10 to 11 hours, and trips aggregating from 45 to 50 miles, is about $4, and this counts only those horses on actual duty on the road. The cost of motive power per day per car for equal mileage in Richmond is less than $2 on the heaviest sort of grade work, and at Boston it is estimated that even this low cost of operation will be reduced. For winter use upon this road the Sprague Company is equipping three electric "working cars," furnished with snow plows, brushes, ice-cutter and salt distributor, and each propelled by two powerful 30 h. p. motors. In front of the car is a revolving wheel which breaks up the snow crust completely, and behind are revolving brushes which sweep the tracks clean. It is estimated that this "working car" will clear a street railway track after a heavy storm more quickly than the ordinary snow-plow, drawn by 12 horses.

The system of wiring which the West End management has adopted for the crowded city streets is the Bentley-Knight conduit, now in use in Allegheny City, Pa. Here the conduit is laid midway between the tracks, and is strongly bolted to the stringers and sleepers. Its cross-section is about a foot square, and its upper part has a slot similar to that used in cable railways, its width, however, being only ¼ of an inch, giving an opening so small that carriage wheels will not catch in it. Besides this it is so beveled that horseshoe calks will not be held in it. Copper bars 1¼ inches thick, one on each side of the slot, firmly insulated beneath it, carry the current, one from the dynamo and the other returning from the motors. The current is taken from the conductors to the motors by "plows," as they are called, two to each car. These plows are thin iron plates about 10 inches square, hung from a frame-work over the middle of the track and projecting into the slot. The motors are connected by controlling switches, and the car is operated substantially as n the overhead system. The plows are so arranged that they can be lifted out of the slot when any obstruction is reached. The current is taken up and returned by spring plates, which slide along the copper conductors at the bottom of the plow. In switching, two ordinary tongue switches are used, one in the conduit and one on the rail. Brushes attached to the snow plows and cars easily keep the conduit and tracks clear, even in the severest snow-storm or in case of slushy and muddy weather. The change from the overhead system to the conduit is made while the car is in motion, and without the slightest delay in travel or inconvenience to passengers, so that the Sprague cars run over the entire distance.

The kind of truck used upon this road is the latest Sprague improved truck, which has recently been fully described in our columns. The equipment of this truck includes the new Sprague "Boston" motor, which will be used for the first time in commercial work upon this road.

The Status of the Julien Storage Patent.

We are in receipt of the following statement from the Electrical Accumulator Company:

THE ELECTRICAL WORLD of December 22, 1888, contains a statement from the Julien Company by which it is made to appear that the application of the Electrical Accumulator Company for a certain patent has been refused by the United States Patent Office. Such a statement is not true; on the contrary, the Commissioner of Patents, Washington, has just rendered a decision sustaining the claims of John S. Sellon as the inventor of an inoxidizable alloy support plate, and Mr. Sellon's patent has been passed to issue, and will shortly appear on the patent records duly assigned to the Electrical Accumulator Company. The application of Sellon was founded upon the specification of his English patent, No. 3,987, dated Sept. 15, 1881. This British patent of Sellon's is the first publication to describe the use of a plate of lead and antimony, or an alloy of two metals, either with or without the use and application of an amalgam as a support for the active material in a battery of the Faure type. The issue of this patent in the United States will enable the assignee of Sellon, the Electrical Accumulator Company, to control the manufacture, use and sale of secondary batteries employing lead and antimony in the composition of the support plates, whether mercury to form an amalgam be present or not, and suits will be instituted in the courts for the recovery of damages at once.

The Danger of Gas Mains as Electric Conduits.

To the Editor of The Electrical World:

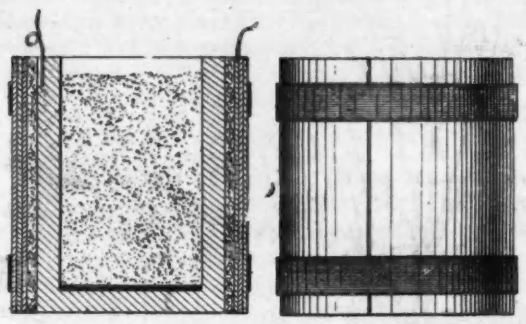
SIR: I notice a description in your Dec. 22 issue of a plan for conducting electric wires through gas mains. This appears convenient on the face of it, but it seems to me to be very dangerous. I believe I am correct in stating that in the event of a fracture or crossing of two wires while the electric current was passing through the circuit the gas would be exploded, and the gas main would be like an extended mine under the streets of the city.

A. R. P.

Wright's Novel Primary Battery.

Our illustrations, Figs. 1 and 2, show in section and in perspective a new form of cell recently designed by Mr. R. D. Wright, of Kirkwood, Mo., with the special object of providing a cell which by the simple addition of acids shall last a long time. To meet this end, the inventor has constructed a cell consisting of a number of sheets which are successively utilized and then replaced by others.

Referring to the illustrations, it will be seen that the battery consists of a carbon cup, the bottom of which is lined with a layer of pitch to prevent the downward passage of the liquid. This cup is filled with pulverized



FIGS. 1 AND 2.—WRIGHT'S NOVEL PRIMARY BATTERY.

carbon or with sand or other absorbent material. The cup is surrounded on the outside by a layer of asbestos, which will absorb moisture. This is a continuous layer and insulates the carbon cup from the sheets of zinc. The sheets of zinc are segmental, and may be applied in any number desired. They are held in contact with the asbestos by rubber bands. No outer jar is therefore required.

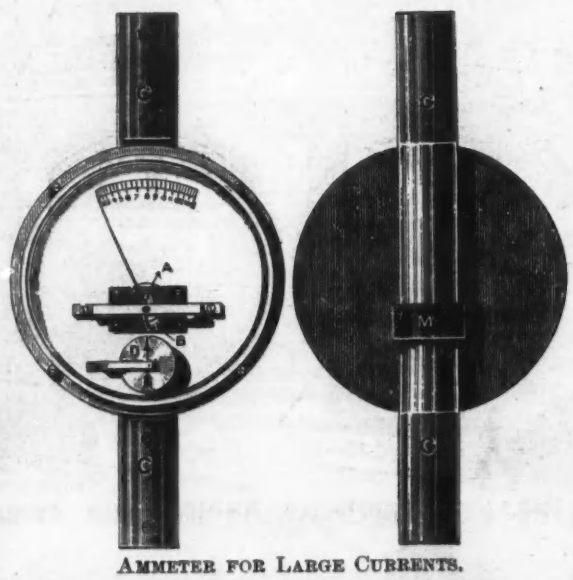
It will be seen that the battery is complete, except for the addition of the acids. These are poured into the carbon cup, saturating the pulverized material which it contains, penetrating its side walls and saturating the layer of asbestos; thence it attacks the zinc, after which it percolates toward the bottom, and finally passes out after it has spent itself.

In another form of battery, where sulphate of copper solution is used, the porous cup is filled with water and sulphate of copper crystals. The solution percolates through the walls of the cup and attacks the zinc. The solution, after acting upon the zincs, passes out in the form of sulphate of zinc through the bottom of the cell, and may be collected if desired.

Any number of zinc layers may be placed in position and held by the rubber bands, and hence the process of amalgamation need be performed only at long intervals. When the inner layer of zinc has become exhausted, the rubber forces in the next one and brings it in contact with the solution coming through the porous cup.

Ammeter for Large Currents.

The instrument illustrated below, says the London *Electrician*, is being introduced by Messrs. Paterson & Cooper for the measurement of large currents, and contains sev-



AMMETER FOR LARGE CURRENTS.

eral valuable improvements made by Mr. S. Joyce, one of their electrical staff. It is of the electro-magnet type, and consists of a round bar of copper *C C*, nearly encircled by a split soft iron ring *M*. On the ring on opposite sides of the gap are fixed pole pieces, between which is pivoted the soft iron needle *A*. The needle is mounted on an axle working in jeweled centres, and is maintained at zero when no current passes, by a spiral spring, as shown. The deflection is indicated by a pointer, which is balanced by a counterweight *B*. When the current passes through the copper bar the ring is magnetized and the needle is deflected. The dial is marked proportionally to the current, the instrument illustrated measuring 1,500 ampères. The dial and the working parts are screwed directly on to the copper bar, the construction admitting of great strength and durability, since no insulation is employed.

The small disc *D* has a magnetized needle fixed at its back, so as to indicate the direction of the current. The accuracy of the indications is unaffected by all ordinary position of the leads to and from the instrument, it being found that when a return is passed down at the back parallel to *C C*, and within one inch of the iron ring, the deflection is altered by only one per cent. Being an electro-magnet instrument there is no recalibration required, nor is there any perceptible error due to residual magnetism. It is made in sizes from 300 to 2,500 ampères or more, and the calibration is effected direct by comparison with one of Sir W. Thomson's kilo-ampère balances. The illustrations show respectively the front and back of the instrument.

Meeting of the American Institute of Electrical Engineers.

A meeting of the American Institute of Electrical Engineers was held on the evening of Dec. 18, when Mr. W. J. Jenks read a paper entitled "Six Years' Experience with the Edison Meter." The lecturer traced the history of this meter from its incipiency, and illustrated by a large number of diagrams the various kinds of mechanical and other meters designed by Mr. Edison. Mr. Jenks' paper brought out prominently the facts that led Mr. Edison to the adoption of the electrolytic meter in preference to the others, and it discussed very fully the objections which had been raised in the past to the employment of such a meter, and the manner in which they were overcome in the present form. The attendance was large, and the discussion was participated in by a number of gentlemen.

After the discussion Secretary Pope read letters of invitation to the members of the Institute from the English Institution of Civil Engineers and the Society of Arts to enjoy their hospitality while visiting England and the Paris Exposition next year. Mr. Pope stated that arrangements are being made to co-operate with the Societies of Civil Engineers and Mechanical Engineers, to whom similar courtesies have been extended. The probability is that the three bodies will have exclusive use of a large steamer at reduced rates, on the outward journey.

A Novel System of Electric Street Lighting.

M. G. A. Tabourin has written to the Municipal Council of Paris offering to light Paris upon his system, which will do away with underground mains, and permit the rapid extension of electric light throughout Paris without interfering with the gas companies. In this most wondrous proposal each gas lamp is to be furnished at its base with a small rotary gas engine, 10 in. in diameter, with a small dynamo, and these small installations are to supply arc lamps on the top of the lamp post, thus burning gas at the bottom and producing electric light at the top of each post. The inventor offers to run at his own cost for several days, opposite the Theatre Français, one of these electric lights on his new system.

Electricity and Underground Haulage.

At a meeting of mining engineers in South Wales, held recently, Mr. J. Fox Tallis read a paper on "The Application of Electricity to Underground Haulage." It was patent, the writer observed, that the old servants, steam, air and water, were limited in their scope of adapting themselves to existing and future circumstances. Colliery proprietors would be the first to admit the inadequacy of present systems to meet the requirements of to-day, and would be the first to appreciate and adopt an improved system that offered greater facilities of transmission over longer districts and more extended areas. Electricity, he contended, had the advantages of being more easily and economically subdivided into a number of paths, fewer moving parts, small and fixed mains, less liability to injury, less space and greater efficiency. The paper did not go into the subject of locomotive motors, as the writer did not consider them practicable, but claimed that the electric motor was the best means for underground hauling. The paper was ordered to be printed for discussion at the next meeting.

Beattie's New Battery Carbon.

In seeking for a new material which should afford a carbon superior to that usually employed in batteries, Mr. John Beattie, Jr., after numerous experiments, has hit upon a carbon made of salt hay or salt meadow grass. This is carbonized, pulverized and molded into the desired form by the aid of any of the commonly used adhesive materials. A recent test was made between this carbon and the standard Leclanché, a sal ammoniac solution being used with the Beattie carbon. It was found, it is said, that the Beattie cell did not polarize for a period of over twenty hours and recovered its full strength in about one hour, while the Leclanché polarized in about twenty-five minutes and required about thirty hours to recover. It was found also upon measurement that the conductivity of the Beattie carbon was about three times that of the gas retort carbon. This would indicate that Mr. Beattie has discovered a material for a battery element which will make a fitting couple with his amalgamated zinc. Mr. Beattie, it may be remarked, claims the credit of being the first to use an amalgamated zinc in a gravity battery.

The "Ideal" Engine.

Most of our readers are already acquainted with the Ide engine, built by Messrs. A. L. Ide & Son, of Springfield, Ill., which is employed in a large number of electric light stations, and which we described some years ago.* Recently Messrs. Ide & Son have completely remodeled their engine, evolving another type, as it were, which, while retaining the good features of the old has added many new ones, specially adapting it to high speed work. This new

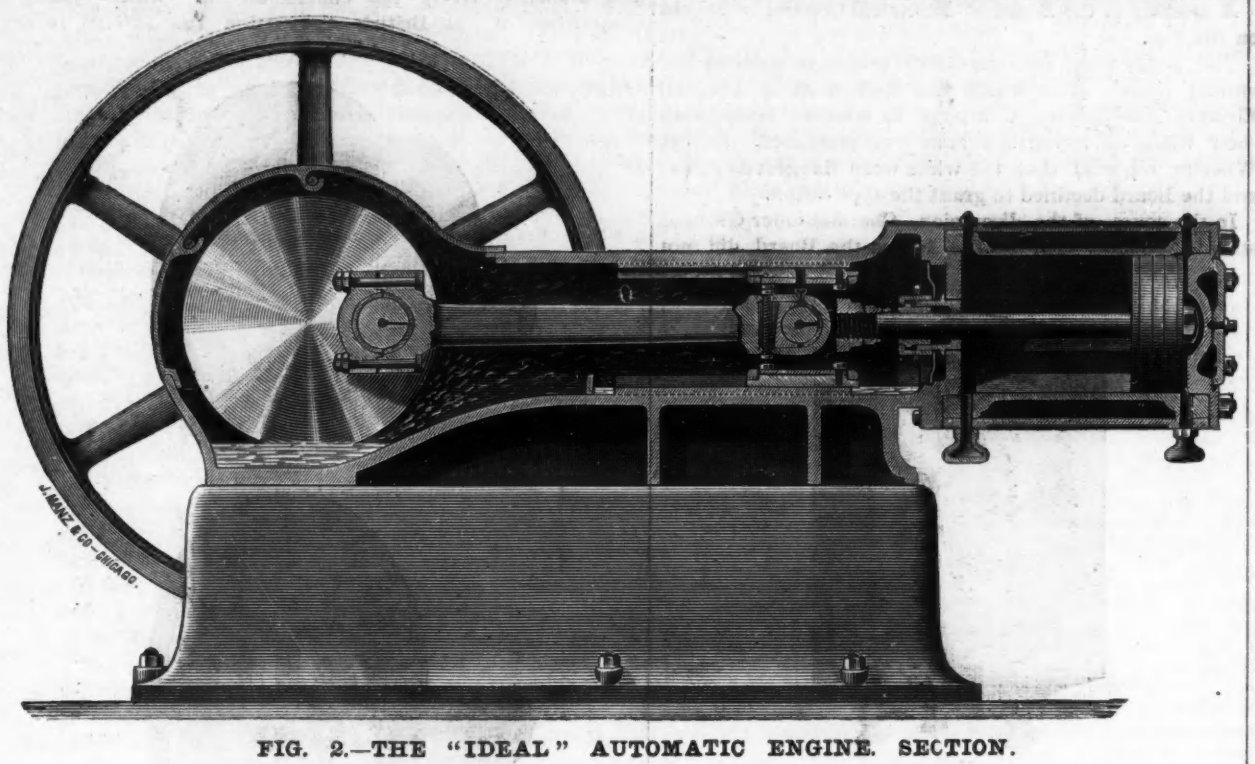


FIG. 2.—THE "IDEAL" AUTOMATIC ENGINE. SECTION.

engine, neatly called the "Ideal," is illustrated in perspective in the engraving, Fig. 1. It has a double frame with two sides, rendering it doubly rigid, with two main shaft bearings and double cranks, which support the driving wheels without the use of outer bearings for the shaft, thus doing away with the overhung crank.

The governor of the new engine has been simplified by dispensing with several parts which experience has proved to be unnecessary. The valve gear has also been simplified by connecting the eccentric directly with the valve stem, thus dispensing entirely with slides, rocker arms, etc.

In the new "Ideal" engine the steam chest is bored out and fitted with a pair of cylinders or bushings which have supporting bars across the ports to prevent any possibility of the valve catching upon the ports. The valve is of the hollow piston type—a hollow tube with a piston at each end. It is surrounded by steam, which presses equally on each end, thus perfectly balancing the valve and relieving it from pressure or friction, and insures long service with little wear. When the bushings are worn they can be withdrawn and new ones inserted and a new valve furnished at small expense. The piston head is a single casting, hollow, and as light as consistent with strength.

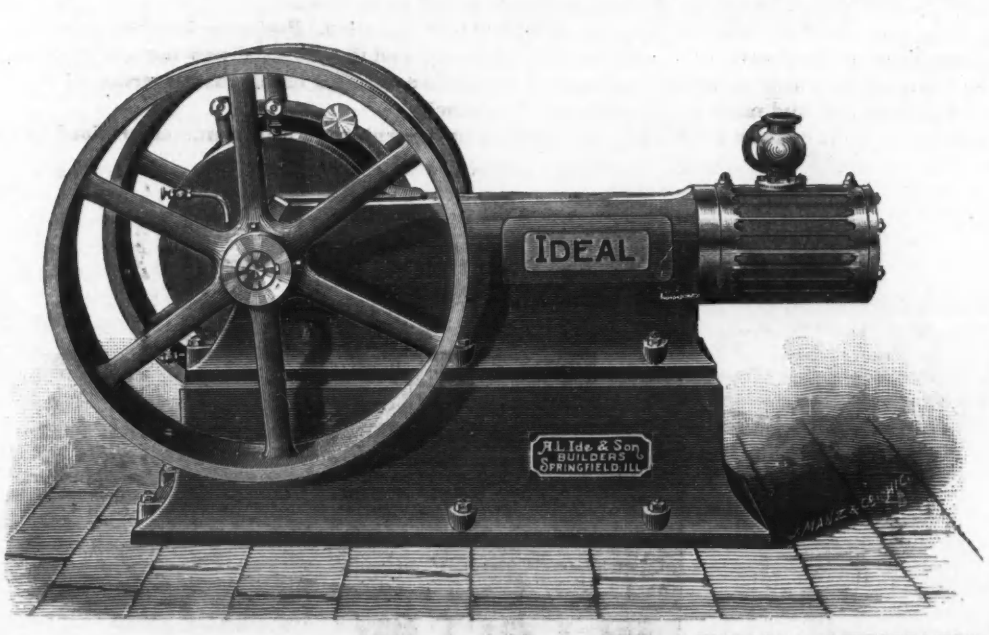
Another unique feature in connection with the engine are the safety-bursting caps or diaphragms attached to the cylinders. In the event of flooding or foaming of the boilers, the caps protect the engine from damage by bursting and allowing the water to escape from the cylinder. One of the special features of the engine is the ingenious method of lubrication adopted, by means of which the use of all oil cups around the moving parts is avoided.

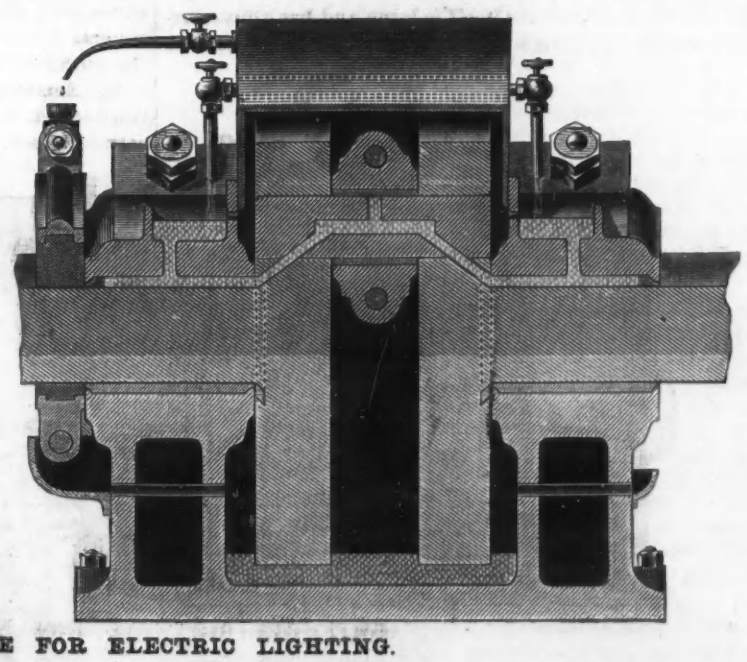
The manner of lubricating the guides and cross-head pin is illustrated in Fig. 2. It will be seen that the oil is thrown upon the guides, and being wiped from the top guide by the slide, passes through a tube in the top slide, entering a funnel in the connecting rod, and after passing through the bearing drips to the bottom of the cross-head. The piston-rod also receives its share of lubrication at the same time.

The method of lubricating the main bearings and crank is specially noteworthy, and will be understood from the engraving, Fig. 3, which shows a section through the crank discs and main shafts, taken in connection with Fig. 2.

It will be seen that an oil chamber is provided under the two crank discs, which is supplied with enough oil to insure the discs dipping into the oil. When the engine discs are in rotation, the centrifugal force causes the oil to be thrown into pockets provided in the hood over the discs, illustrated in Fig. 3. From these pockets the oil flows through the pipes into a receptacle or pocket cast upon the main bearings. From this point it flows into the groove and channel connecting with the crank-pin, which is hollow. The centrifugal force carries it into the crank-pin, from which it escapes through two holes into the bearing. Thus it will be seen that the main bearings receive constant lubrication, while the lubrication of the crank-pin is insured by the supply of oil from each side. This method of lubrication is constant and perfect, and provides for the most important bearings about the engine. Sufficient oil is placed in the basin under the crank discs so that it will flow in streams through both pipes to the main shaft bearings, and in drops to the eccentric; but valves are provided on the pipes so that the supply can be regulated as desired, and the oil chamber or basin can be supplied with fresh oil while the engine is running. The oil from this chamber can be drawn off by a cock in the end of the frame communicating with the pocket and used over again. Besides the saving in oil, these devices keep a clean and presentable engine and engine room.

We may add that Messrs. Ide & Son are now building a 200 h. p. "Ideal" engine for the Florence, Ala., Electric Light Company; a 100 h. p. for the Edison Electric Illuminating Company, Salida, Colo., and a 75 h. p. for the Gainesville, Tex., Electric Light and Fuel Company.





FIGS. 1 AND 3.—THE "IDEAL" AUTOMATIC ENGINE FOR ELECTRIC LIGHTING.

* THE ELECTRICAL WORLD, Jan. 26, 1884; March 15, 1884.

Solder for Telegraph Wires.

In answer to an inquiry Mr. W. H. Preece writes as follows in the London *Electrical Review*:

Soldering is a term applied solely to the process of uniting the surfaces of metals. It is done by the intervention of a more fusible metal than that which has to be united. The soldering metal being melted upon each surface, serves partially by chemical affinity, and partially by the exertion of cohesive force, to bind them indissolubly together.

Solder is usually an alloy. It must not only be more fusible than the metal or metals to be joined, but it must have some chemical affinity for them. Hence different sorts of solder are employed for different purposes. It is called either hard or soft, according as its fusing point is high or low.

Thus there are:

1. Hard pewterer's..... .....2 bismuth, 4 lead, 3 tin.
2. Soft " .....1 " 1 " 2 "
3. Hard plumber's.....1 " 2 "
4. Soft " .....3 " 1 "
5. Hard spelter.....12 zinc, 16 copper.
6. Soft " ....Equal parts zinc and copper.
7. Telegraphic solder..... Ingot tin and pig lead are taken in equal parts by weight, and melted together.

Hard spelter is used for copper and iron purposes and soft spelter for brass work. There are also particular solders used for gold and silver work.

The test of efficiency of solder is a peculiar creaking sound, called the "cry of the tin," which is heard when a stick is bent close to the ear.

Electro-Physiology.

At Owens' College, Manchester, Professor Stirling recently delivered a lecture on the electrical properties of the tissues, but especially of those composing the nervous system. There are about fifty species of fishes which are known to have specially modified organs for the generation and discharge of electricity. These organs, when at rest, do not discharge their electricity; but if the animal be irritated electrical shocks are discharged, which in some fishes are very powerful indeed. By means of electrical discharges these animals not only stun their prey, but they ward off the attacks of their enemies. The animal may discharge its batteries voluntarily, but after having done so for a considerable number of times the electrical organs become fatigued, just as muscles after severe exercise are fatigued. At first sight it might seem remarkable that certain animals are provided with structures which evolve powerful discharges of electricity. This, however, is not by any means the most remarkable fact. When we know that the whole of the body of the animal is traversed by the electrical current at the moment it is discharged, it does seem far more wonderful that the tissues of the animal itself are not thereby affected; not even a muscle is caused to contract, although the discharge must necessarily traverse the nervous system as well as the muscles. The animals, therefore, have an immunity from the effects of their own shocks. Darwin admitted that the presence of these organs in a limited number of fishes was a fact not easily explained on the evolution hypothesis. Recent researches, however, have shown that the electrical organs are really modified muscular organs, or the terminations of nervous structures in muscles. This fact greatly simplifies the problem. Muscles and nerve, however, evolve electricity in the living condition; and a variation of the electrical conditions of a muscle, a nerve, or even of protoplasm generally is one of the best signs of the vital activity of these structures. With Galvani's experiments on the twitchings of the limbs of frogs, there commenced the investigation of electrical phenomena, which have led to such splendid results, not only in physiology, but to the development of new means of producing electricity and its numerous applications in the arts. The lecturer demonstrated the classical experiments of Galvani, Volta, Nobili, Du Bois-Reymond, and others, show-

ing historically on what lines our present knowledge of animal electricity had been reached.

The "Mayo" Dynamo and Lighting System.

We publish herewith an illustration of the "Mayo" incandescent machine, manufactured by the Van Depoele Electric Manufacturing Company, of Chicago. In the one

FIG. 2.—LAMP.

hundred light machine shown in Fig. 1, 99 lamps may be thrown on or off by a single movement of a switch without causing an appreciable change in the remaining lamp.

The adjustment of the commutator brushes is very simple, and the commutator itself is large and has ample surface, so that sparking is nearly eliminated. The segments are insulated with mica, and the shafts are of high grade steel and of ample size, and run in very long bearings, which are made of Babbitt metal.

The armature core of the machine is built up with discs of thin sheet iron, separated by paper, and each bobbin lies in a groove made in the metal of the core to receive it, so that there can be no movement of the wires. The pole pieces are cast from the best hematite iron, and the field magnets are forged from old horseshoes, thus giving the best results with the smallest expenditure of energy.

The lamp and socket illustrated in Fig. 2, is manufactured in sizes from 10 to 150 candle-power each. The holder or socket is very simply constructed. Two kinds are used, the plain or keyless sockets, and the key sockets, which may be turned in either direction for turning the light on or off.

The Mayo double pole switch, is shown in Figs. 3 and 4, and Figs. 5 and 6, represent, respectively, the voltmeter and fuse box employed in the system.

Subway Board Proceedings.

A meeting of the Board of Electrical Control was held on the 21st.

The Board went into executive session to consider the annual report, after which the application of the Ball Electric Illuminating Company to connect lamps with their wires on Seventh avenue was presented. Expert Wheeler reported that the wires were dangerously low, and the Board declined to grant the application.

In the course of the discussion, Commissioner Gibbens stated distinctly that in the future the Board did not

FIG. 5.—VOLTMETER.

intend to have wires going from one side of the street to the other, but that the companies must stick to one side of the thoroughfare. A permit was granted to the North New York Company to erect poles, on condition of its maintaining, as far possible a straight route, and conforming to the other regulations, and it was requested to change its style of poles.

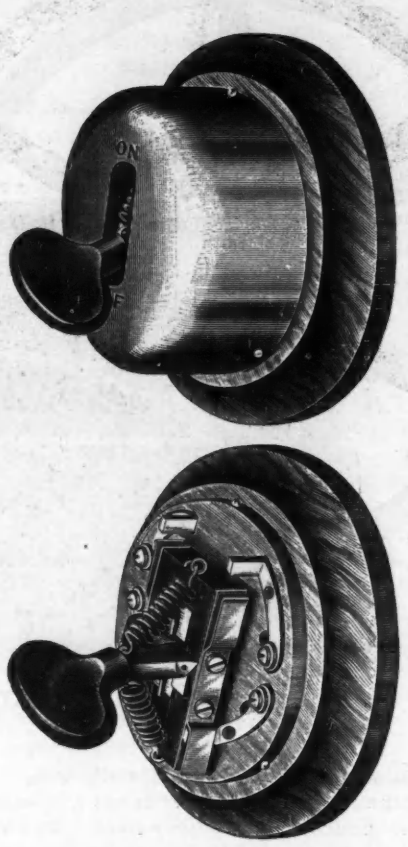
Ex-Judge Rollins appeared in support of the applications for permits of the Mount Morris Company. There were also applications from the Ball Illuminating Company, the East River Company, the United States, the Harlem, the Brush, the Western Union and the Edison Electric Illuminating Companies, most of which were granted, subject to the approval, by the expert, of the route and the character of the wires, materials and posts proposed to be adopted. This was in line with the recommendation of the expert, that uniformity in the detail as well as the general construction of lines was absolutely essential to the success of the future operations of the Board.

Mr. Emanuel Hart, who has a stereopticon at Twenty-third street, has been recently burnt out, and made a very earnest appeal to the Board for leave to connect his lamp with the United States Illuminating Company's wires. The Board, however, said it appreciated the position it holds with regard to the injunction now hanging over it at the instance of the United States Company, and declined at this particular season to run the risk of being imprisoned for contempt of court. The Board, however, expressed its perfect willingness to grant the permit if the application were made through the United States Company.

The Board adjourned to meet at the Mayor's office, where its sessions will in future be held, on such a day after Jan. 1, as may be convenient to the Mayor.

Meeting of the New York Electric Club.

The regular meeting of the Electric Club was held at the club-house on Thursday evening, the 20th. After the transaction of business, Prof. C. F. Brackett, of Princeton College, gave an extemporaneous lecture treating of matters that present themselves to the working electrician as well as the student. He devoted considerable time to the specific conductivity of copper wire, and also to its relative weight and conducting power, and discussed freely the conclusion at which the committee of the British Association has arrived in



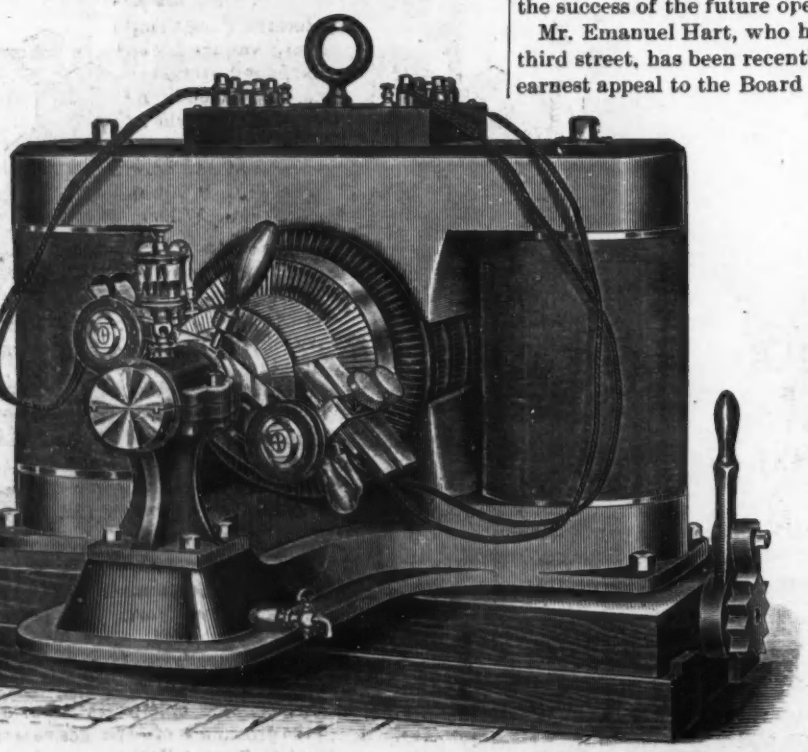
FIGS. 3 AND 4.—SWITCH.

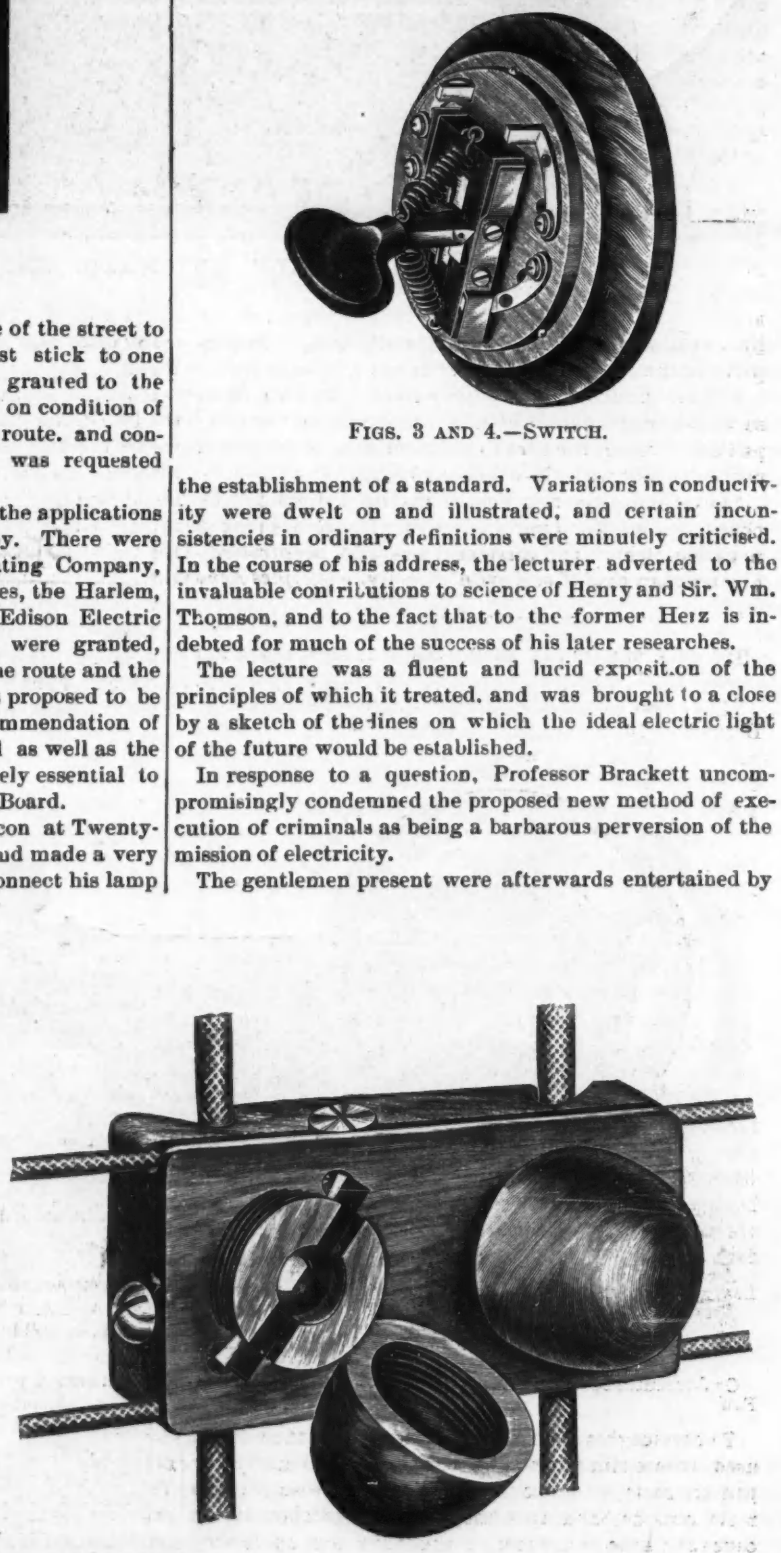
the establishment of a standard. Variations in conductivity were dwelt on and illustrated, and certain inconsistencies in ordinary definitions were minutely criticised. In the course of his address, the lecturer adverted to the invaluable contributions to science of Henry and Sir. Wm. Thomson, and to the fact that to the former Herz is indebted for much of the success of his later researches.

The lecture was a fluent and lucid exposition of the principles of which it treated, and was brought to a close by a sketch of the lines on which the ideal electric light of the future would be established.

In response to a question, Professor Brackett uncompromisingly condemned the proposed new method of execution of criminals as being a barbarous perversion of the mission of electricity.

The gentlemen present were afterwards entertained by the Electric Club with its usual hospitality, and the company separated at a late hour.





FIGS. 1 AND 6.—MAYO DYNAMO AND SAFETY FUSE.

Phenomena Produced by Electric Discharges on Eastman's Pellicular Paper.

BY M. E. L. TROUVELOT.

If we effect a discharge from the positive pole of an induction coil upon the sensitized surface of a sheet of Eastman's negative paper, we perceive the ramifications of the spark designed in marks of fire upon this surface, and on developing we obtain a bold image comparable to

that obtained by the same process on glass plates. If we make the same experiment with the negative pole the results are different; we recognize then only some short ramifications upon the pellicle. If we raise up slightly the corner of the pellicle, we observe that the line of fire has traversed the pellicle and the paper, and continued its course to the surface of the plate of glass supporting the condenser on its opposite side. On developing, the marks perceived on the pellicle appear rapidly, and it is perceived that they are considerably thickened at certain points, and much resemble certain mosses which grow upon the branches of trees. These mossy portions often terminate in the form of a club at the very point where the luminous line traverses the pellicle, as if their formation was due to the resistance offered by this pellicle to the passage of the spark. If we carry out the development of such a proof, we see traces, more or less distinct, of the ramifications which have been produced under the pellicle which is found impressed on its lower surface through the paper.

If we take a proof thus obtained when it is fixed and well dried, and after placing it on the condenser we cause a discharge of the coil to take place upon the corresponding point where the first discharge has taken place, we observe a singular phenomenon. If we discharge the *negative* pole upon a proof which gives an image of *positive* electricity, we remark from the first discharge faint whitish lines, which lengthen and widen gradually after other discharges which succeed to the first; these whitish lines, which look as if finely drawn with chalk, follow exactly the ramifications of the positive proof in all its branches. If we make a similar experiment by discharging the positive pole upon an image of the negative electricity, nothing similar appears, whatever is the number of the discharges produced.

We often see the images given by the discharges of the positive and negative poles intermixed in the same proof. If we direct discharges of the negative pole upon the same proof, we see gradually the positive ramifications appearing white, whilst the negative ramifications remain unaltered, except where these ramifications are accompanied by positive lines following the same track. Similar experiments made with proofs on glass give no result.

If examined with the microscope, these whitish lines seem to result from thousands of minute blisters of the pellicle, doubtless occasioned by the rise of temperature due to the passage of electricity over the same lines.

These experiments show anew the difference of the characters of the opposite electricities, and prove that negative electricity possesses a power of penetration far greater than that of positive electricity.—*Comptes Rendus.*

Recent Problems of American Watch Manufacture.

In a paper read before the Boston Electric Club, on December 19, Mr. H. E. Duncan described the new non-magnetic watch now being made by the American Watch Company, at Waltham, Mass. We abstract the following passages:

A balance spring in all quick train watches is called upon to perform its duty five times each second, or 18,000 times per hour. Steel in its hardened and tempered form has always served the purpose in a satisfactory manner till this magnetic age, and to find a non-magnetic substitute was one of the greatest problems ever solved. An alloy of platinum has been found that out-rivals steel for a balance spring, and that its elasticity is not a property of rolling or drawing is shown by the fact that even on heating the spring to a red heat it loses none of its elasticity when brought to its original temperature. Were it not for one property of springs, namely, to slightly change their elasticity with each change of temperature, a plain balance of some non-magnetic metal could be used. It has been found by experiment that the temperature errors are as follows in a watch in passing from 32 degrees to 92 degrees Fahr.

Loss per day, due to expansion of diameter of balance..	62	sec.
" " by loss of spring's elastic force.....	312	"
" " " elongation of spring.....	19	"
	393	sec.

Or 6 minutes 33 seconds per day, or $13\frac{1}{10}$ seconds per degree Fah.

To correct this error of the spring, a balance has been used, whose rim is made of two metals of unequal expansive ratio, with the metal of the greatest expansive ratio outside, and this method of construction would cause the ends of the rim to approach the centre of the balance, reducing its diameter sufficiently to correct the loss of time due to loss of elasticity in the spring. The metals used for years for this purpose were brass and steel. The brass was non-magnetic enough for all purposes, but the steel must go. A metal was found, and today we have the non-magnetic watch that goes on a faithful time-piece even when surrounded by magnetic lines of force.

It is in this balance, when made of brass and steel, that magnetism has its greatest effect in affecting the time-keeping qualities of the watch. D.d time permit I would have arranged to repeat before you a very delicate experiment lately successfully tried at our factory. A watch balance of the usual steel and brass construction, but showing no trace of residual magnetism, was made to vibrate, and the number of vibrations noted in five-minute intervals by a most delicate device controlled by electricity, and repeated tests gave the same number of vibrations exactly. The balance was then magnetized, and the experiment repeated under the same conditions of temperature and duration; the balance in the latter experiment showed a loss of a number of vibrations equal to twenty-four seconds per hour. And by repeating the last experiment with the magnetized balance cutting the lines of force of a very small magnet near it, it would increase or further decrease its number of vibrations equal to an interval of 4.9 seconds per hour.

This is what takes place in the watch that becomes magnetized. The balance is opposed or attracted by the ever-changing polarity of the mainspring of steel in the performance of its duty, and makes plain why a nearly constant factor of magnetism put in a watch will give the most unsatisfactory results in time-keeping.

A Magnificent Present to John W. Mackay.

There has been on exhibition at the Gorham Manufacturing Company, Nineteenth street and Broadway, a rich and beautiful piece of silver plate, representing the Commercial Cable Company's system, in a chaste design for a centre piece. It is in the form of a globe and is a magnificent production of the silversmith's handiwork. The standard is a piece 22½ inches in diameter supported upon four wrought standards. The base is concave and gleams with the lustre of gold satin. The rim is a facsimile of a telegraphic cable. Each standard has a typical figure. North is a female holding a magnet, signifying the lode star and its influence. South is another female figure graceful in design, holding tropical fruits in her hands, together with a palm leaf. East and West are male figures, the former carrying a shield on which is an Egyptian sun, and the latter a tablet showing the setting sun. From the centre of the base rises an ornate raffle, upon which dashes the foam of a restless sea. In the centre are three dolphins bearing upon their backs the globe. Pendant from the mouths of the dolphins is a miniature submarine cable resting on the bed of the ocean. The globe is a remarkable piece of work from a geographical point of view. The Mackay-Bennett lines are shown by delicate gold cables. The total height is 19 inches, and in its manufacture 480 ounces of fine silver were used.

It is a Christmas present from the officers and staff of the company, to its president, Mr. Mackay, to commemorate the fourth anniversary of the opening of its cables to the public, and as an expression of their esteem for him. This will be accompanied by a beautifully illuminated album, containing an address and the signature of every member of the staff throughout the line.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, Dec. 24, 1888.

The Electric Construction and Supply Company

has on hand the installing of a 500-light incandescent plant in the dry goods district.

Edison Plant.

Mr. F. R. Chinnock reports the sale to the Brooklyn Wire Nail Company, Greenpoint, L. I., of an Edison plant of 150 lights.

Personals.

Mr. Jarvis B. Edson, the manufacturer of the Edson steam pressure recording and alarm gauge, begins to feel that his apparatus is making the headway that it should among the electric light companies, many of whom are prompt with their testimonials as to its value. The latest order comes from the Edison Company of Kansas City.

Hazaer & Stanley,

of 32 Frankfort street, have issued a very neat and tasteful calendar for 1889, in which the pad is mounted on a silvered full size print of one of their 5-inch nickel bells. The wire, also faithfully shown, is brought to the binding post, so as to close the circuit for a new year. One can imagine the hammer to be on the stroke of 12 midnight to ring in the newcomer. The monthly slips are hung from the face of the iron box, to be detached in the usual way.

The John Stephenson Company, Limited,

builders of street cars, have recently completed a new car for the Julien Electric Traction Company for the Fourth avenue line. This car will be much lighter than those now running there, but there will not be any sacrifice of strength, and it is in this fine adjustment to conditions that the Stephenson Company has gained so much of its well-earned reputation. I must say it is a great pleasure to see the electric cars operating so smoothly and regularly. I had a six-mile run in one of them last week, and derived more solid satifaction and comfort from it than from any horse car ride I ever took.

The Non-Magnetic Watch Company of America.

Mr. E. T. Gilliland has entered upon active work as treasurer of the above company, under the change recently noted by you, and he has with him Mr. C. P. Bruch as secretary. A concern with which two such well-known names are coupled ought to do a very large business, and I have no doubt the Paillard watch will be more extensively introduced than ever. Mr. David Ward, of Michigan, is president, and his son, Charles W. W., is the general manager. Mr. A. C. Smith will continue the general sales agent as heretofore, with headquarters at 177 Broadway. The company will increase their capital and their output, and make ready for a much larger demand.

Engines for Electric Light Plants.

Williams & Potter, 15 Cortlandt street, agents for the Straight Line engine, will furnish two 60 h. p. engines for the United States plant that will be put in the new *Times* building. The Freundschaft Club will have one of 135 h. p. to run the Excelsior Company's incandescent plant. One of 80 h. p. will run the Mather plant in the new Amberg Theatre, and one of 50 h. p. will run the Westinghouse system for the Metropolitan Electric Company of St. Louis. The Sawyer-Man plant in the Brooklyn Tartar Works will have one of 35 h. p., and one goes to the Pratt & Whitney Machine Works, of Hartford. Another goes in our only American steel ship flying the Stars and Stripes, engaged in Southern trade, and will operate a United States machine.

Car Lighting.

The Railway Electric Car Lighting and Signal Company was organized some four months ago at 120 Broadway, under Julien auspices, for the purpose of lighting cars, etc., on the Barrett system. Mr. Barrett started on this line of work in 1887 on the Connecticut railroad, running between Springfield and North, ampton and making four trips. The train has made 125 miles every night lighted in this way, and Mr. Leonard of the railroad company says that the result has been entirely satisfactory. The care of the plant is confided to the brakeman on the train. The officers of the company are W. Bracken, president; H. G. Morris, vice-president; H. R. Waite, secretary and treasurer; H. Weston, solicitor, and S. H. Barrett, field superintendent. The company has issued a neat little pamphlet descriptive of its plans and methods. Special details are given as to the method of having an engine and dynamo on board the train itself for charging, and as to the method of having only the batteries, to be charged at termini and changed. A few points are also given as to electric signaling on cars in place of the old bell cord.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
178 Devonshire Street, Boston, Dec. 24, 1888.

Personal.

Mr. George Cornwall, representing the Hartford Dynamic Company, was in Boston Wednesday, Dec. 19, on a business visit.

The Boston Electric Club.

The first meeting of the subscribers to the agreement to incorporate the Boston Electric Club will be held on Thursday, Dec. 27, at 8 o'clock P. M., at the club rooms.

The New England Electric Exchange.

The directors and examiners of the Exchange had a little dinner at the Hotel Thorndike on Dec. 17, when they were joined by Mr. S. E. Barton, Mr. Killecutt and Capt. Brophy. A very pleasant evening was spent, and those present felicitated themselves on the good work being done.

Proposed Electric Elevated Railroad.

Mr. R. T. White, of Boston, has applied to the Massachusetts Legislature for a charter to build, equip and operate an electric railway (under his own patents) in the city of Boston and suburbs; and over such routes as the authorities will permit. The motive power is to be either electricity or cable.

Additional New Offices.

The Thomson-Houston Electric Company has leased additional offices in the Hathaway building (on the ground floor), and these are to be fitted up with a large variety of the company's incandescent electric light apparatus, fixtures, etc., etc. The new quarters will be known as the isolated lighting department, and will be under the management of Mr. James R. Magee, who has been connected with the shoe and leather trade of New England for twenty years.

A Fibre Monopoly.

The Portland Indurated Fibre Company, of Portland, Me., has absorbed its strongest rival, the Lockport Indurated Fibre Company. The combination will reorganize as the United Fibre Company, with a capital of $500,000. Additional buildings will be erected at Lockport, N. Y., and the new company expect to have a monopoly of the indurated fibre goods trade. Among those interested in the concern are C. A. Brown, F. J. Rollins and C. D. Brown, of Portland, Me.; G. P. Amsden and B. Frank Brown, of Concord, N. H., and Senator William A. Russell, of Boston.

The Wright Electrical Engineering Company

has recently been incorporated. Mr. Alex. P. Wright, of the United Electric Light Company, of Springfield, Mass., has resigned his position of manager of the latter company to take the entire management of the new company as managing director. The new company will prepare plans and specifications of electric light and power plants and electric railways, and will contract for the erection of same. It is their intention to do the very best of work, and they will employ none but competent men of known ability and long experience in charge of every branch. Mr. Wright comes to Boston at once to organize the working arrangement.

A New Catalogue.

The New England Electric Supply Company, Bridgeport, Conn., has just had printed a handsome little catalogue, in which its electrical products are set forth in a neat and artistic manner. Mr. J. M. Orford, for several years the superintendent of the Bridgeport Electric Light Company, and Mr John C. English, for a long time prominently identified with electric lighting enterprises in various sections of New England, are the promoters of—and active workers in—the New England Electric Supply Company, and the name and reputation of these gentlemen are a guarantee of a large and steadily increasing patronage to their new enterprise.

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., Dec. 24, 1888.

Taylorville, Pa.

The Taylorville Electric Light, Heat and Power Company, Lycoming County, with a capital of $160,000, was granted a charter by the State Department last week.

Underground Wires.

In Common Council last Thursday a resolution was adopted authorizing the Director of Public Safety to confer with the elec-

tric light companies using Chestnut street with a view of having all their wires placed underground in accordance with the law. A fatal accident a few days ago has agitated the subject of underground wires with fresh vigor, as it is claimed that sufficient conduits are already in position to accommodate them.

Street Lighting.

A joint Special Committee of Councils, appointed under a resolution to ascertain if a more desirable method can be adopted by the city for lighting the streets with electric lights, was to have held a meeting last week, but for the want of a quorum an adjournment was necessary. The purpose of the inquiry is set forth in the preamble to the resolution, which states that the city is paying to the various electric light companies $129,000 per annum for the lighting of 755 electric arc lights on the streets; that it has been openly asserted that this sum is excessive, and that for $300,000 a fully equipped plant can be erected by the city which will supply from 2,500 to 3,000 street lamps at an expense to the city of not more than $90,000 per annum; and that many of the present lights are not more than 1,200 candle power, while the companies are under contract to furnish lights of not less than 2,000 candle power.

The Legal Status of Local Lighting Companies.

A dispatch from Pittsburgh says: "The fact has just leaked out that the State Supreme Court at its late session here delivered an opinion in the case of the city of Scranton against the Electric Light Company to the effect that not one of the electric light companies in Pennsylvania to-day has a legal corporate existence. They were chartered under the act of 1874, which provides for the creation of no such corporations, just as was the case with the natural gas companies, which could not be regularly incorporated until an act authorizing an issue of charters had been passed by the Legislature. It is understood the Westinghouse Electric Company, of this city, has had an act prepared for submission to the next session of the Legislature, which was made retroactive so as to cover all operations thus far. The Westinghouse Company has acquired control of the two competing companies here, and arrangements have been about completed for merging them into a large concern."

Candle-Power Tests.

Director Wagner last Thursday afternoon received and opened proposals for lighting the streets of the city with electric lights during next year. There were about a dozen bids received, but only one was deemed satisfactory by the Director, owing to the failure of bidders to specify the candle-power of the light, as required by the specifications, and all bidders were instructed to prepare others to meet the requirements and present them; otherwise all proposals would be rejected. The Director stated that the difficulty last year was as to how the test of 2,000 candle-power was to be established, but this year matters were so arranged whereby each bidder was to manage his own test. "The right was to be reserved," he said, "to have tested the candle-power of any light, and to reject any not up to the standard mentioned in the bid. Now, these bids before us are not in accordance with the specifications. The basis on which the candle-power is to be ascertained has been omitted." The bid accepted was from the Wissahickon Electric Light Company, who offered to furnish electric lights on the highways between Allegheny avenue and Levering street at 55 cents per lamp per night.

Electric Killing Experiments.

Quite a little disappointment was caused to those who had expected to witness the killing of Forepaugh's vicious elephant "Chief" by electricity during the present week, by reason of the adoption of other means of dispatching the brutal pachyderm. Last Sunday "Chief" became so vicious that it was necessary to resort to some immediate means of killing him and one of Forepaugh's sons, who is an elephant trainer by profession, was called in. He slipped a noose around "Chief's" neck, and to each end of the rope two smaller and more obedient elephants were attached and commanded to pull in opposite directions. The scheme worked, and in twenty seconds the monster whose record of human victims numbered over half a score, and whose money value nine years ago was $10,000, had been strangled to death. "Chief" was about 34 years of age, and the University of Pennsylvania have undertaken the task of removing the hide and preserving it, as well as the skeleton. Electricity as a means of killing the animal was suggested after rifle bullets had failed to produce any effect, and the sudden outburst of the animal's cruel wrath was the only thing which made the delay necessary to arranging a sufficiently strong current a barrier to its adoption.

E. W. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, Dec. 22, 1888.

New Corporations.

Incorporation license was granted this week to the Perkins Lamp and Electrical Supply Company at Chicago, capital stock $250,000, for the manufacturing and dealing in incandescent electrical lamps, supplies and machinery; incorporators, W. G. Halm, J. H. Ward and M. C. Neuberger.

License of incorporation was issued last week by the Secretary of State at Springfield to the Colby Hardware and Electric Company at Chicago, capital stock $50,000, for the manufacture of electric and other devices; incorporators, S. K. Briggs, Charles Loughridge and H. L. Forbes.

The Belding Motor and Manufacturing Company.

The annual meeting of the stockholders of the Belding Motor and Manufacturing Company was held on Dec. 6, the following directors being elected: Geo. W. Henry, of the Henry & Coatsworth Lumber Company; Thos. G. Crosby, of Crosby & McDonald, marine insurance; Thos. H. White, of White & Dexter, iron miners; Albert F. Dexter, of White & Dexter, iron miners; Warren S. Belding, electrician. The officers of the company elected are: President, G. W. Henry; vice-president, A. F. Dexter; secretary and treasurer, T. H. White. Among the recent motor installations of this company are 1 h. p. for S. M. Hall, 2 h. p. for Keen & DeLang; ½ h. p. for N. W. Masonic Aid Association.

From St. Louis.

Messrs. J. H. Siegrist, Jr., & Co., St. Louis agents for the Brightman Stoker Company, write me that they have been awarded the contract to furnish the Brightman mechanical stoker for the boilers in the new power house of the Union Cable Railway Company, Kansas City, Mo. The company have also just finished erecting four stokers at the new Limberger building, and four stokers at the new Odd Fellows' building. The Limberger building stokers are running very successfully, the Odd Fellows' building stokers are to be started shortly.

These machines are being introduced into the electric light stations with very gratifying results, the Thomson-Houston Electric Light Company of Buffalo, N. Y., having three of them.

Aerial Photography.

It is reported that M. J. Steffens, of this city, has just patented an invention which he claims will be of great service for military and scientific purposes. It is aerial photography by means of electricity. A camera is attached to a balloon and sent aloft to an elevation varying from 500 to 10,000 feet. The camera, which works automatically, contains a roll of sensitized paper thirty to forty feet long. As many as sixty different impressions can be taken. The camera connects with a battery on the ground and is manipulated by an ordinary telegraph key. The camera is regulated by means of a wind fan, which reduces oscillation to a minimum and keeps the lens at the proper angle. Mr. Steffens says that photographic views of the surrounding country can be secured over a radius of thirty to forty miles. Experiments will be made as soon as a machine can be constructed.

Street Railways in St. Louis.

A special from St. Louis of Dec. 16 reports that the control of the four St. Louis street railways has been transferred to Chicago capitalists. The Chicago syndicate is composed of C. B. Holmes, C. L. Hutchinson, E. Mendell, Edwin G. Forman and D. G. Hamilton. In reviewing the purchase Mr. Hamilton is reported as saying that the roads will be put in the best possible shape, both as to appearance and utility. In his opinion Cass avenue would almost certainly be cabled. He was, however, much averse to saying anything as to the plans of the purchasing syndicate. It was learned from a good source, however, that the syndicate when organized will be known as the National Railway Company, and their stock will be $4,000,000. The National Company will have 36 miles of track—13 on the Citizens', 7 on the Northern Central and 8 each on Cass and Union. The Northern Central and Union will probably continue to be operated as horse car lines, largely as feeders, with transfer tickets to the others at convenient points, though it is not unlikely that they will be changed to some electric system before next fall.

Telephone Matters.

A prolonged session of the Finance Committee was held on Monday last for the consideration of the telephone question. Druggists and other agitators for cheaper rates were present. The Corporation Counsel was asked to explain his opinion concerning the status of the Bell Telephone Company, and the Mayor was also called on for advice. As a result of these conferences, it was determined to amend the compromise ordinance so that the telephone company shall pay 3 per cent. of its gross earnings to the city; that its ordinance shall terminate in twenty years unless renewed; that the Bell Telephone ordinance of 1878 shall be repealed by the acceptance of the new ordinance by the Chicago Telephone Company; that rates shall not be increased in any of the telephone districts of the city over the rates now prevailing. It was also determined to make more explicit the city's right to avail itself of any new legislatiod that might be enacted to empower it to regulate rates or to impose a tax. The amendments were referred to the Corporation Counsel for incorporation in a new ordinance, which will be reported to the council at the adjourned meeting this week. The visiting delegation urged the council to defer action until after the decision of the Missouri Supreme Court.

Ide and "Ideal" Engines for Electric Lighting.

A. L. Ide & Son, Springfield, Ill., are building two Ideal engines of 200 h. p. each for the Chicago Edison Company; a 50 h. p. for the Florence Electric Light Company, of Florence, Ala.; a 100 h. p. for the Edison Electric Light Company, Salida, Col., and a 75 h. p. for the Gainesville Electric Light and Fuel Company, Gainesville, Texas. Among their recent shipments are an 80 h. p. Ide engine to the Gas Company, Madison, Wis.; a 60 h. p. Ideal for the Electric Light Company, Oconto, Wis.; a 50 h. p. Ideal for the Electric Light Company, Marquette, Mich.; a 75 h. p. for the Thomson-Houston Electric Light Company, Marshaltown, Ia.; a 25 h. p. for the electric light plant at Petersburgh, Ill.; a 40 h. p. for the Edison Electric Light Company, Monmouth, Ill.; 30 h. p. for the Norton, Kansas, Electric Light Company; 100 h. p. for the Economy Steam Heat Company, St. Paul, Minn.; 25 h. p. for Walter Tipps, Austin, Tex.; 60 h. p. for Edison plant at Evanston, Wyo. T.; 50 h. p. for the electric light plant at Holton, Kan.; 50 h. p. Reisch Bros.' brewery, Springfield, Ill.; 25 h. p. Geo. Challoner's Sons, Oshkosh, Wis.; two 60 h. p. Baker's Theatre, Chicago; 75 h. p. Keller & Mead, Marion, Ind.; 75 h. p. United States Electric Company, Clinton, Ia., and 60 h. p. Metropolitan Electric Company, St. Louis, Mo.

E. L. P.

SOUTHERN NOTES.

ASHEVILLE, N. C., Dec. 14, 1888.

The Asheville Electric Light Company have enlarged their building, and are adding a 100 h. p. boiler, a 75 h. p. Armington & Sims engine and a feed-water heater capable of supplying both boilers. They are overhauling their steam plant entirely. They are also putting in a 50,000 watt Edison dynamo to furnish current for a Sprague road, which is now nearly completed. This road will be 3¼ miles long, and includes some tolerably heavy grades and sharp curves. The company will also before long establish a motor circuit, for which the Sprague stationary motor will be adopted. The entire steam work is being done by the Pond Engineering Company, of St. Louis, and the electrical work by the Sprague Company. T. W. Patton is secretary and treasurer of the company, and J. H. Barnard superintendent.

ENGLISH NOTES.

LONDON, Dec. 1, 1888.

The Chelsea Electricity Supply Company.

The Chelsea Electricity Supply Company recently addressed a memorial to the Chelsea Vestry with regard to the invasion of their district by the ubiquitous London Electric Supply Corporation, asking the vestry to decline to sanction their application to lay down certain underground mains in Chelsea. The not unnatural request of the memorialists has been rejected. It would seem, therefore, that the chief apparent advantage, namely, a modified monopoly, conferred by a provisional order from the Board of Trade, is completely illusory. However, the matter will certainly not be allowed to rest here, but must be thoroughly thrashed out and authoritatively settled.

The Woodhouse & Rawson Dynamo.

The well-known firm of Woodhouse & Rawson, who up to the present have confined themselves to the manufacture of lamps, switches, cut-outs, and other light electrical work, are now launching into heavy engineering. They have recently brought out a neat and compact type of shunt-wound dynamo, intended chiefly for mining and plating work, and designed with a view to meet the requirements of those who want a machine needing but little attention, and not easily damaged by rough handling. The armature is of the shuttle type, and the appearance of the machine is very similar to that of the Kapp dynamo. No less than 28 of these machines have lately been supplied to a single London firm, so that it would seem that the makers' claims are not exaggerated.

The Mining and General Electric Light Company

A company has recently been formed with the above title to acquire certain patents relating to a portable storage battery lamp. The capital is £100,000 in £1 shares, and the price to be paid for the patents is £80,000, viz., £46,000 in cash, £20,000 in fully-paid shares, and the balance at the option of the directors in cash or fully-paid shares. A 15 per cent. dividend is dangled before the eyes of the public, but considering that it is based on "an estimated annual sale of *only* 80,000 lamps," it may not inappropriately be termed mythical. The technical press is naturally unanimous in condemning this venture; for with three patent cases now occupying our law courts and wasting the profits of the unfortunate holders of the patents, it is scarcely a propitious moment to pay £80,000 for a patent storage battery lamp.

The Edison-Swan Appeal Case.

The hearing of the appeal in the case of Edison-Swan *vs.* Holland and others, came on before Lords Justice Cotton, Lindley and Bowen on Saturday last. Sir William Grove, the distinguished scientist and inventor, and late a justice of the High Court, also occupied a seat on the bench. Your readers will remember that this is an appeal from the decison of Mr. Justice Kay, who invalidated the Edison incandescent lamp patent upon the ground of insufficiency in the description. The Attorney-General opened the case on behalf of the plaintiffs at very great length, dealing chiefly with the experiments which had been carried out by the defendants in order to prove the impossibility of working the patent. These experiments, he said, were admirable examples of the art of how not to do it, and he endeavored to show in full detail that according to their own witnesses the method of carbonization adopted could not possibly lead to satisfactory results. On the other hand, the experiments of the plaintiffs, many of which were carried out by boys and girls, without other instructions than those contained in the specification, had clearly demonstrated that every method therein described by Edison would lead to a practical lamp. The case is still proceeding.

The Edmunds System of Electrical Distribution.

The discussion on Mr. Henry Edmunds' paper at the Society of Telegraph Engineers and Electricians, read recently, was not of a specially interesting character. All the speakers agreed in praising the extreme beauty and ingenuity of Mr. Edmunds' method, which you have already described, but there was a general concensus of opinion that no definite conclusion, as to the value of the system, could be arrived at in the entire absence of data respecting cost. From an inspection of the automatic switch, which was placed upon the table (and which certainly performed its work in the most satisfactory manner), it would seem to be impossible to manufacture the apparatus for less than £50 or £60. In fact one manufacturer was heard to say that he should not care to turn them out for less than £100 apiece. Upon this question, Mr. Edmunds has hitherto maintained silence. When I remind your readers that this system requires an apparatus of this kind, as well as a set of storage cells, to be placed on the premises of every customer, I fear that your practical men will scarcely regard it very hopefully. In addition to this, there is also an increase of cost owing to the necessity for using one-third more cells than are actually required at one time. Mr. Edmunds claims as a set-off that the central station plant need be only one-third the size demanded for the maximum output. It would, however, seem that it is scarcely feasible to work upon so narrow a margin as this, at any rate in London, because whenever—as too frequently happens in our climate—the lights are required more or less all day long, then it is evident that the total output of the system is limited to that which can be continuously supplied by the station. One of the most interesting features in Mr. Edmunds' method of working is the entire absence of any automatic device for maintaining a constant current. His method is to allow the engine to run without any governor, but to maintain a perfectly constant steam pressure; the dynamos are also separately excited from storage cells. We have then a constant magnetic field and a constant torque upon the armature, and it is known that under these circumstances a constant current is necessarily produced. The disadvantage of the arrangement is that when running light the engine is also running very slowly, and therefore with a great want of economy. However, this disadvantage is partially counterbalanced in this particular system by having several small dynamos in series on the mains and cutting them out of circuit in succession as the cells become fully charged and are automatically switched off. Mr. A. P. Trotter and Mr. Bernstein adopted this method of working some

time ago, but I do not know whether the result was considered satisfactory.

The Pilsen-Joel and Maxim-Weston Companies.

Within the last few days two electric light companies have finally submitted to the inevitable and proceeded to perform the "happy dispatch." On Nov. 23 the directors of the Pilsen-Joel Company were recommended by their shareholders to take the necessary steps for the voluntary liquidation of the company, and a few days later the Maxim-Weston Company also went into voluntary liquidation, but in this case with a view to re-construction. The Pilsen-Joel meeting passed off without much discussion, although there were, evidently, two opinions as to the advisability of winding up, as well as to the past conduct of the directors. I think there can be but little doubt that under more able and energetic management, the Pilsen-Joel Company need never have terminated its existence in such an unsatisfactory manner. The Maxim-Weston meeting, on the other hand, was not without incident. A shareholder, Sir Henry Hart, inquired what was the position of the company, and what were the allegations against Mr. Hugh Watt. He had been always treated with the greatest courtesy by Mr. Watt, and although Mr. Watt was not in very good odor with the meeting, he (Sir Henry Hart) felt compelled to put in a kind word for the late chairman. Mr. John Newton and the new chairman (Mr. John Marks) immediately proceeded to enlighten Sir Henry Hart, and the history was once more detailed at length. Mr. John Newton said that if any one wished to know what Mr. Watt had done for the company he could only reply that "Mr. Watt had had possession of the company for some years, and when he left it there were no funds in the till and no business of any moment being done." Mr. John Marks said the position of the company when the new directors took office was that of a concern "with a balance of £2 16s. and writs of all kinds flying about." To meet these writs the new directors borrowed £1,000 on their own security and had the accounts of the company investigated. What did the accountants find? "That the balance sheet which Mr. Watt issued to the shareholders was absolutely false. Mr. Watt showed a false profit of £1,500, and took 5 per cent. commission on the amount. Not only did he take 5 per cent. commission on that profit, but the actual sales which he had entered in the books as *bona fide* sales were found to be bogus sales, entailing a serious loss on the company. This was what Mr. Watt had done for the company!" Sir Henry Hart then thanked the chairman for his "extremely open, candid and explicit statement." On Mr. Watt's solicitor mildly protesting against these strictures, the chairman reminded him that the Solicitor-General in the case of Watt vs. Cameron had used still worse language about his (the solicitor's) client. The new company, I may add, is to take over the debts, liabilities, etc., of the old and to start with a nominal capital of £46,800 in 312,000 shares of 3s. each; but as 2s. per share is to be considered as paid, the actual capital of the new concern will only amount to some £15,000.

THE TELEGRAPH.

Western Union Stockholders now number over 32,000.

Fire Alarms.—The Electric Auxiliary Fire Alarm Company has been incorporated in Maine by J. H. O'Neil and P. F. Murphy, of Boston, with a capital stock of $250,000.

Spirit "Sounders."—The spiritualists in this city are about to introduce a new wrinkle or trick into their methods of communication with departed souls in the other world. Rapping was found too slow, and slate writing, the most popular method with mediums hitherto, has grown tame. The new messages are sent by spiritual telegraphy through the hand of the medium, and are delivered by a telegraphic "sounder." This form of communication has recently been introduced in Cleveland, O. The sounder is an ordinary one, such as is used by soulless telegraphic corporations. The medium's hand is held over it, and as the spirits move the fingers they will strike the key. The tedious old rapping alphabet will be dispensed with, and the Morse alphabet substituted. A little five-year-old boy in this city who is regarded as a great medium will work the telegraphic instrument here.

The Pacific Cable.—On the subject of Australian opinion respecting the proposed cable from Australia to Vancouver, Principal Grant said at Field, British Columbia, on his return to Canada: "The merchants of Melbourne are a unit on the subject. Sir Thomas McElwrath, premier of Queensland, heartily concurs with Premier Gilles, of Victoria, and thinks that the sooner a steamship line is established the better. Sir Henry Parks, premier of New South Wales, denied that his colony was opposed to the enterprise, as was reported. In seconding a vote of thanks at a meeting in Sydney he spoke in favor of it. The members of his government spoke similarly in private. South Australia is no longer opposed to it since her interests in the transcontinental lines to Port Darwin are not to suffer by the proposed new route. On public grounds her leading men and those of West Australia desire an alternative cable, and all the prominent New Zealanders I met are strongly in favor of it."

Canadian Telegraphs.—The directors of the Montreal Telegraph Company are expressing dissatisfaction with the report of Erastus Wiman, president of the Great Northwestern Telegraph Company. The latter company, it seems, can only pay a dividend of 6 per cent., instead of 8 per cent. Mr. Wiman says that that the discontented directors have not expressed their views to him personally. The cause of the reduction was simply the fact that the Great Northwestern Company was not earning a sufficient income to pay an 8 per cent. dividend. The net revenue for the past year had been $186,361.73, and the amount of the annual payment to the Montreal and Dominion companies was $242,500, leaving a deficiency in 12 months of $56,138.27. This condition was largely the result of a competition for a business in itself meagre and barely self-sustaining on one hand and a lavish expenditure of public money by a organization backed by the government on the other. The Canadian Pacific Railroad Company had established a thoroughly-equipped telegraph system. The growth of telephone service had also cut into the telegraph business. The shareholders, Mr. Wiman thought, should be congratulated upon receiving 6 per cent. dividends under the conditions.

THE TELEPHONE.

A Telephone Victory.—A special dispatch from St. Louis of Dec. 20 states that the Supreme Court of Missouri has decided that the city has no right to regulate the charges of the telephone company as attempted by recent ordinance.

The Pan Electric Litigation.—A special dispatch from Washington of Dec. 17 says: In the case of J. Harris Rogers against A. H. Garland and others (known as the Pan Electric case), the defendants, Joseph E. Johnston, Isham G. Harris, John D. C. Atkins and Casey Young, to-day filed their answer. The object of the bill was to dissolve partnership and for accounting of the Pan Electric Company. Mr. Garland had filed an answer but the others filed a demurrer which some weeks ago was overruled by the court in General Term, and leave was given to answer. This answer was filed to-day by Gen. Eppa Hunton. In it the defendants deny that they have failed or refused to perform any agreement with the complainant, and assert that they have endeavored honestly and in good faith to conduct the enterprise, and charge that the complainant has in every possible way hindered them. They deny that they have received any salary as officers. They assert that they have sold none of their stock nor received a single dollar. If the court finds that there is any contract now existing they join in the prayer for its dissolution. They deny that complainant has the right for an order for accounting, as he has sold all his interests as a stockholder.

THE ELECTRIC LIGHT.

Versailles, Ky.—An electric light plant is to be put in by Captain Henry and his son.

Webster, Mass.—J. W. Dobbie and others are incorporators of the Citizens' Electric Company.

Fort Worth.—Bids for 200, 300 and 400 city lights are to be received until Jan. 1 by Mr. E. B. Daggett.

Hallowell, Me.—The Hallowell Light and Power Company is to have its town lights running by Jan. 20.

Philadelphia, Pa.—Morse, Williams & Co. are putting in an incandescent plant to light their entire factory.

Sherman, Tex.—A city committee is now considering the feasibility of the proposed incandescent lighting plant.

Knoxville, Tenn.—The Knoxville Electric Light and Power Company have spent about $10,000 on additional plant.

Oconto, Wis.—The Oconto Electric Light Company has been incorporated by G. Beyer and L. K. Fisher, with a capital stock of $20,000.

Tiffin, O.—The Tiffin Electric Light Company has been incorporated by J. W. Schamplerger and others, with a capital stock of $40,000.

Cambridge, Mass.—The Cambridge Electric Light Company will put in four more 125 h. p. boilers and a 500 h. p. condensing engine.

Middleboro, Mass.—It is proposed to locate a $25,000 plant at Middleboro. The station will be run by water power from the Newmarket River.

Washington, O.—The Washington Electric Light, Heat and Power Company has been formed by D. McLean and others, with a capital stock of $10,000.

St. Johnsbury, Vt.—Mr. J. Ross has obtained an injunction to prevent the authorities of St. Johnsbury from carrying out their contract for a Thomson-Houston service.

Westinghouse Stock.—Special news dispatches from Pittsburg, of Dec. 24, speak of a marked rise in Westinghouse stock, owing to reports of important negotiations now pending in New York.

Camden, Ark.—The Camden Water-Works Company have awarded the contract for their works to J. W. Bates & Co., of Liberty street, New York. The company propose to erect an electric light plant also.

Fort Wayne, Ind.—The Fort Wayne Jenney Company will, it is said, rebuild at that place if the city will guarantee the erection of water-works equal to such a large fire as that which recently occurred. Alliance, O., and South Chicago both want the company.

Charleston, W. Va.—The Kanawha Electric Light Company, of Charleston, W. Va., has just purchased an additional 50-light arc dynamo of the Thomson-Houston Electric Company. This makes their plant consist of 100 arc lights and about 1,000 incandescent.

David City, Neb.—Mr. J. Bell, the grain elevator man, has started a new plant at David City, Neb., of 30 arcs and 300 incandescents, all of the Thomson-Houston system. Power is furnished by a Corliss engine. The lights have only just been put in operation, but nearly all the capacity has already been taken.

Springfield, O.—The service from the electric light plant at Springfield was interrupted on Dec. 14 by a crude oil fire, the oil being used as fuel under its boilers. The loss is estimated at between $1,000 and $2,000, and there is an insurance of $10,000. It is believed that hereafter the company will use coal instead of crude oil.

Carrolton, Mo.—Mr. J. W. Lacy is operating both the electric light plant and the telephone exchange at Carrolton, having acquired the former by purchase last month. The plant comprises two Sperry 20-light arc machines driven by a Ball engine. Mr. Lacy intends to put in incandescents, to be run from storage batteries charged in the day time, and will introduce this service at the beginning of the new year.

The Thomson-Houston Factory.—The Boston *Sunday Herald* of Dec. 16 contains a long and interesting illustrated article on the big works of the Thomson-Houston Electric Company at Lynn, Mass. 1,100 men and 200 women are employed in the various departments, which now cover over three acres of floor space, require a steam plant of 500 h. p., and are lit by 1,200 incandescents and 300 arcs. It is a story of wonderful growth and achievement.

Elegant Cars on the Erie.—The Erie Railway has just received another consignment of Pullman vestibuled sleeping cars, the finest that have ever been delivered by that famous company. All the modern improvements, such as provision for hot and cold water supply, together with an arrangement for steam heat, electric light, etc., have been applied. These cars are to be run between New York and Buffalo on train No. 3, leaving New York at 8:30 P. M., and train No. 12, leaving Buffalo at 5:30 P. M.

Train Lighting.—It is well known that the Boston & Albany Railroad runs through trains from New York to Boston, consisting of palace cars, and lighted throughout (including the baggage cars) by Julien storage batteries. These cars have now been lighted continuously in this way for about two years. It may be of interest to our readers to know that within the last year, and since the Boston & Albany Railroad has learned to handle and operate the batteries with proper skill, the depreciation has been very small. Although there are 12 tons of battery in daily service, or nearly $10,000 worth, the depreciation since May 27 last to the present time was, it is said, only $266 worth of battery, connectors, jars, etc.

APPLICATIONS OF POWER.

Summerville, S. C.—The Summerville Street Railway Company propose to make their road an electric one.

Gardiner, Me.—A number of business men are interested in an electric road to be run between Gardiner and Togus.

Lynchburg, Va.—The Lynchburg Street Railroad Company expect to have their electric system in operation by next spring.

Aldermen and Storage Cars.—The question of permission to substitute electric cars for horse cars on the Fourth Avenue road, this city, came up again in the Board of Aldermen last week, and failed to pass by only one vote.

Fulton Street, New York.—The East and North River Railway Company, which has had its tracks down in Fulton street for some time, began last week to equip for the Bentley-Knight system by putting in conduits, and the work is going on rapidly. It is said that cars may be running by February. The conduits are being laid not between the rails, but between the two tracks, so that but one continuous opening of the street has been necessary.

Los Angeles, Cal.—Mr. C. B. Holmes, the well known Chicago street railway engineer and capitalist, has, at the head of a Chicago syndicate, bought the Los Angeles Daft electric railway, which has some eight miles of track. Mr. Holmes, who has already done so much to insure and advance the success of cable roads, promises to put the Los Angeles road in the best shape, and he is a man of his word. The city will soon have a service to be proud of.

PERSONALS.

Mr. M. M. M. Slattery, the electrician of the Fort Wayne Jenney Company, has a neat Christmas gift in the shape of a $25,000 prize in the Louisiana lottery.

Mr. C. M. McNett, of the Washington office of the Thomson-Houston Electric Company, left that city on the 25th inst. for southern California, where he goes in hopes of recruiting his health. He expects to remain there for five months, and has left his business with Capt. C. A. Ballou, of Danville, Va., who, with the assistance of the Southern Electric Light, Power, and Construction Company of that city, will look after the interest of the Thomson-Houston Company in Virginia, West Virginia and North Carolina.

MISCELLANEOUS NOTES.

The Spellier Electric Time Company, recently formed in New Jersey by W. B. Bennett and others, has a capital stock of $200,000.

The Jones Brothers' Electric Company, of Cincinnati, has been incorporated by W. H. Jones and others with a capital stock of $100,000.

St. Louis, Mo.—The Missouri Electrical Society, of which Mr. S. P. Baird is secretary, has started quite hopefully and promises to do very good work.

Meteorological Studies.—The New England Meteorological Society proposes to hold, during January, a loan exhibition of apparatus, etc. The exhibits will include electrometers and apparatus connected with atmospheric electricity, and photographs of lightning. The exhibition will be held at the Massachusetts Institute of Technology, whither articles may be sent in care of Mr. A. L. Rotch, Physical Department, who may also be communicated with at the Blue Hill Observatory, Readville, Mass. Mr. Winslow Upton is the secretary of the meteorological society.

Haverhill, Mass.—It has been proposed by Haverhill parties to utilize the water power at Mitchell's Falls, a point up the Merrimac River about two miles, for electrical uses. A meeting was held in Haverhill for a careful consideration of the question, many prominent citizens being present. The natural and physical conditions of the power were fully explained, the height of the fall was given and many of the gentlemen present expressed their views on the subject. A committee of five was appointed to thoroughly investigate the matter, procure surveys and to report at a subsequent meeting. The committee is to consist of Messrs. Thomas Saunders, Charles Corliss, John Pilling, Chas. W. Morse and George A. Hall.

The Buffalo Electrical Society.—The Buffalo *Express* of Dec. 16 publishes a sketch of the good scientific work done by the Buffalo Electrical Society, and publishes the portraits of its leading members and officers, Messrs. F. Kitton, W. Finn, G. H. Usher and A. C. Terry, together with biographical sketches. President Terry is a Canadian by birth, Mr. Kitton and Mr. Usher are American, and Mr. Finn is English. It must be a matter of pride to these gentlemen and their associates to know that they have given their local society a high place and an enviable reputation among bodies devoted to scientific work and the pursuit of knowledge for its own sake.

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal Street, N. Y., carry a complete stock of iron and brass machine wood screws, bolt, cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

The Star Manufacturing Company, of 46 School street, Boston, report a very flattering increase in the demand for their "Star" belt dressing, particularly from electric light people, who find it very reliable and efficient for their purposes. This company send their goods out subject to approval after use, a novel departure from the usual methods.

The Phœnix Glass Company, 729 Broadway, have on exhibition two elegant solid silver onyx lamps, made from special designs and given as prizes at the regattas thisyear. The glassware on these lamps is also of the very latest design and most finished production in cut crystal glass. Such splendid specimens of artistic handicraft should be seen by everybody.

J. B. McCoy & Co., makers of gas and electric fixtures, are closing out at a sacrifice many fine lines of fixtures, at their salesrooms, 140 Green street, this city, preparatory to moving to their new headquarters, 5 and 7 Thompson street, where they are refitting the main floor of their factory as elaborate and attractive salesrooms, expecting also to get great facilities and convenience in thus having their departments together.

A Convenient Calendar and Stand for 1889, is the Columbia Bicycle, issued by the Pope Manufacturing Company of Boston, Mass. The calendar proper is in the form of a pad of 365 leaves, one for each day. The leaves are 5⅛ × 2¾ inches, a portion of each is left blank for memoranda, and as the leaves are sewed at the ends, any entire leaf, as well as the memorandum blank, can be exposed whenever desired. The pad rests upon a portable stand, and when placed upon the desk or writing table the entire surface of the date leaf is brought directly before the eye, furnishing date and memoranda impossible to be overlooked. The upper portion of the stand is made of pressed pulp, with "Columbia" in raised letters at the top, the whole handsomely gilded, and practically indestructible. Although this is the fourth year of the Columbia calendar, the quotations are fresh and new, and are interesting and instructive to the public as well as to the 'cycler.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS ISSUED DEC. 18, 1888.

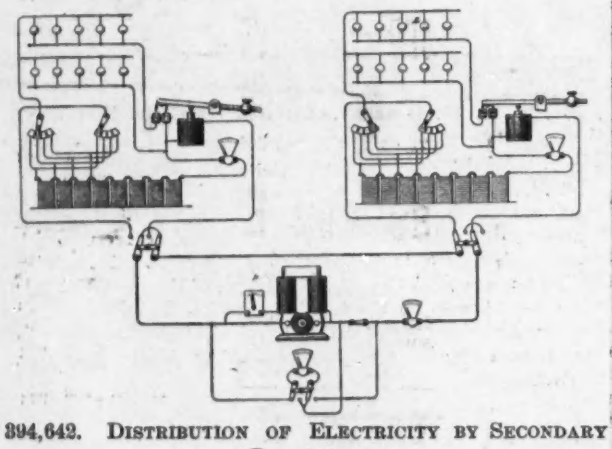
394,555. Annunciator; Wm. C. Clark, Portland, Me. Application filed Oct. 20, 1888. Consists of an armature mounted and sliding on a post or spindle erected between the two poles of a magnet, a thimble integral with the armature, and a revolving sleeve carrying a drop and resetting arm mounted on the same post, the revolving sleeve having a projection to correspond with a recess in the end of the sliding thimble.

394,568. Switch or Circuit Changer; W. W. Griscom, of Haverford College, Assignor to the Electro Dynamic Company of Philadelphia, Pa. Application filed Oct. 24, 1888 Consists of a double regulating switch composed of a series of bars of varying lengths, the terminals of which are arranged in the arc of a circle. A rotating radial arm is pivoted at the centre of the circle of which the bar terminals form an arc, and may thus be placed in contact with the terminal of any bar.

394,613. (2) 394,614. (3) 394,615. (4) 394,616. (5) 394,617. (6) 394,648. (1 and 2) Separating Partition for Galvanic Batteries; (3) Treating Diaphragms and Cups for Use in Electric Batteries; (4 and 5) Diaphragms for Galvanic Batteries, and (6) Separating Partition for Galvanic Batteries. L. L. Roberts and H. L. Brevoort, of Brooklyn, Assignors to the Roberts-Brevoort Electric Company, Limited, of New York, N. Y. Applications filed, respectively, May 5, 1887; Aug 7, 1888; Oct. 6, 1888; Oct. 27, 1888; Oct. 27, 1888, and May 1, 1886. For description see page 340, this issue.

394,621. Electric Tramway; M. H. Smith, Halifax, England. Application filed May 4, 1886. The invention consists of an improved form of conductor supported in a channel, also in the construction of the channel and its connected parts, and in the arrangement of parts whereby the currents are collected from the conductors and transmitted to the car or motor.

394,624. Electric Brake System; W. P. Widdifield, of Uxbridge, Canada, and A. H. Bowman, of Packerton, Pa. Application filed Feb. 8, 1888. Claim: In a system of electric brakes the combination with a friction pulley of a given size adjustably geared to the car axle, a mechanical connection between the axle of the pulley and the brake lever, and a smaller pulley of less diameter also adjustably geared to the said car axle and connected through a chain with the operating lever of the large pulley, the said smaller pulley being connected to the armature of a solenoid which is included in a suitable electric circuit.



394,642. DISTRIBUTION OF ELECTRICITY BY SECONDARY BATTERIES.

394,642. Distribution of Electricity by Secondary Batteries; Thomas P. Conant, New York, N. Y., Assignor to the Electrical Accumulator Company, of same place. Application filed Oct. 25, 1888. The improvement consists in dividing the working circuit into two sections, one to be supplied by the battery, and the other by the dynamo when operating to supplement the battery. In the working circuit is placed an automatic switch operated by an adjustable electro-magnet which is located in circuit between the dynamo and battery. When the proper current is flowing from the dynamo, the switch is closed and the section of the working circuit to be fed by the dynamo is connected; but the moment such current from the dynamo fails, the switch opens and the dynamo section of the working circuit is disconnected. This avoids possible injury to the battery. See illustration.

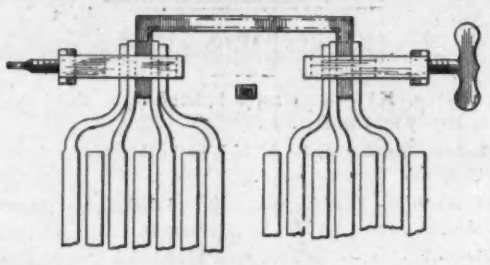
394,670. Galvanic Battery; R. D. Wright, Kirkwood, Mo. Application filed May 14, 1888. For description see page 342, this issue.

394,697. Telegraphy; P. F. Jamieson, Batavia, Ohio. Application filed Sept. 24, 1888. The object of the invention is to provide a telegraph system in which the key used in sending messages will automatically close the circuit as soon as released by the operator, thereby avoiding the necessity of switches and the inconvenience arising from leaving the line open.

394,728. Indicator for Electric Circuits; Oliver B. Shallenberger, Rochester, Assignor to the Westinghouse Electric Company, of Pittsburgh, Pa. Application filed Oct. 11, 1888. The invention consists in so organizing two solenoids and their respective cores, that when one core is in a position to be acted upon by its solenoid with a maximum effect, the other core is approaching a corresponding position with reference to its solenoid, and as the first core passes beyond the point of maximum effect, the second core reaches its position of maximum effect, so that the increase of attraction upon one core will compensate for the decrease of attraction upon the other core. See illustration.

394,735. Electro Magnetically Propelled Vehicle; Wm. L. Stevens, Boston, Mass. Application filed April 19, 1888. Claim: The combination, in an electro-magnetically propelled vehicle, of a series-wound motor, a main battery for supplying the current to run the motor, a main switch for controlling and varying the current supplied by the battery, a speed switch adapted to vary the strength of the field magnets of the motor, and a supplemental battery adapted to be connected with and disconnected from the field coils of the motor by the switches.

394,784. Electric Signaling Apparatus; G. F. Milliken, Boston, Mass., Assignor to the Gamewell Auxiliary Fire Alarm Co., of same place. Application filed June 21, 1888. An electromagnet in a normally open circuit, the same being provided with an armature retracted to a position intermediate between its extreme front and rear limits, so that when the armature is at rest the circuit which passes through its magnet



394,897. CONNECTOR FOR SECONDARY BATTERIES.

helices, a battery, the armature itself, and through vibrating contacts at the rear limit shall remain open.

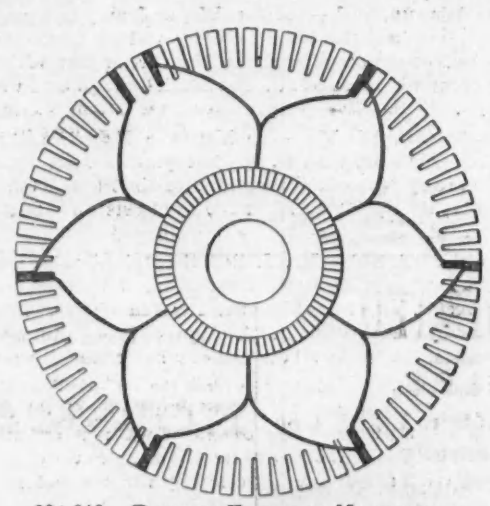
394,791. Electric Arc Lamp; R. Shefbauer, Dresden, Germany, Assignor to Weber & Schelbauer, of same place. Application filed April 7, 1887. This lamp is capable of operating in any position, whether horizontally, vertically or otherwise, and with the controlling mechanism at either end, and which, under the influence of vibrations, shocks or other disturbing operations, such as arise upon locomotive engines and on board ship and otherwise, will not interfere with the quiet burning of the lamp.

394,797. Collector; John Tregoning, Lynn, Mass. Application filed Sept. 12, 1888. The invention consists in collector rings composed of three pieces of metal, which pieces are of peculiar shape and easy construction. Designed especially for dynamos employed in electric welding, *i. e.*, for heavy currents.

394,807. Electro Therapeutic Tool Holder; A. H. Bacon, Webster Groves, Missouri. Application filed Nov. 5, 1888. Consists, mainly, in incorporating in a tool handle an electric battery having conductors leading therefrom and so disposed about the handle and provided with such electrodes as to enable an electric current to be transmitted through the hand while manipulating the tool.

(1) 394,818. (2) 394,819. Dynamo-Electric Machinery; Chas. S. Bradley, Yonkers, N. Y. Applications filed July 25, 1887, and Jan. 10, 1888. (1) The armature is constructed so that it reaches out to the faces of the pole pieces and entirely fills the cylindrical armature space, whereby the armature core is as nearly in contact with the pole pieces as is practical for its rotation, and the copper conductors or windings are sunk in grooves formed lengthwise in the periphery of the core. By properly proportioning the projecting iron ribs left between the grooves on the iron drum the inventor finds that all eddying or local currents in the bars are to a large extent prevented. See illustration. (2) In a bar armature bifurcated end connectors having greater heat conducting and radiating capacity than the bars.

(1) 394,832. (2) 394,833. Telephone Systems; John F. Casey, St. Louis, Mo. Applications filed April 9, 1888, and Aug. 7, 1888. (1) The invention consists in an extended call circuit between central offices, which is provided with one or more operators' outfits, and also in providing the switch-boards at said central offices with a trunking section or devices and means whereby trunk connections can be quickly made at each office. (2) Claim: The combination, with a telephone exchange system having talking circuits and call circuits independent thereof of an electrical connection between any of said call circuits and one or more of the talking circuits, whereby when any of the call circuits become impaired the independent talking circuits may be used as call circuits.



394,818. DYNAMO-ELECTRIC MACHINERY.

(1) 394,837. (2) 394,838. Conveying Electric Energy; S. Z. De Ferranti, Hampstead, England. Applications filed Sept. 24, 1888. (1) The end of the cable is led around the insulator and back to a clip through an eye in which it is threaded, and it is then led to the metal head of the insulator and electrically connected with it. The clip is made to embrace the conductor, and is shifted to such a position as is requisite to give the desired tension in the span. (2) The cable is connected with the supporting wires by links of leather such as to be instantly destroyed by the heat of an arc if formed in its vicinity.

394,839. Magneto Generator for Fire-Alarm Circuits; William L. Denio, of Rochester, N. Y., Assignor of two thirds to Daniel B. Platt and Herbert L. Bunnell of same place. Application filed July 13, 1888. A magneto generator embodying a field magnet and an armature, a motor for rotating the armature, a stop for holding it in check, and a joint embodying a readily fusible material for holding the stop in position.

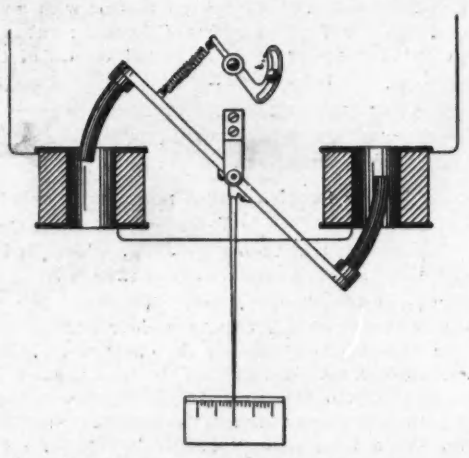
(1) 394,880. (2) 394,881. Electric Meters; A. Reckenzaun and James A. Pentz, of Philadelphia, Pa. Application filed Jan. 20, 1888. For description, see page 338 this issue.

394,883. Dynamo Electric Machine; George W. Riethmann, Denver, Col. Application filed March 10, 1888. A field core and polar extension, cast in one piece and divided by breaking at or near the neutral line, means for uniting these separated parts, a field coil upon the core, a revolving armature and a commutator.

394,887. Electric Locomotive; S. H. Short, Denver, Colo., Assignor to the United States Electric Company, of same place. Application filed Oct. 23, 1886. In this locomotive the motor is mounted on a frame insulated from the vehicle. A change in the direction of running is effected by changing the gearing instead of reversing the motor.

394,892. Portable Electric Welding Apparatus; Elihu Thomson, Lynn, Mass. Application filed Aug. 16, 1888. The general object of the invention is to provide a portable apparatus which may be used in welding sections of lead pipe or iron together, forming joints between wires and similar operations under conditions where the joint or weld must be made with the objects in the place which they will permanently occupy.

394,897. Connector for Secondary Batteries; H. H. Wiegand, Baltimore, Md. Application filed April 17, 1888. The clamp for connecting the terminals is designed to unite them in such a manner that the fluids of the battery cannot penetrate and corrode the joint, and thus impair the contact. It consists of a frame composed of any suitable insulating material or of metal coated with an insulating substance, or with an alloy similar to that of which the grids are composed. Within the opening of the frame are located two blocks of insulating material, one fixed against the end of the frame and the other movable in suitable ways formed in the frame. A screw having a cross-head passes through a hole in the end of the frame without touching, and works in a fixed nut formed of the same kind of metal as the screw, but insulated from the frame. The inner end of the screw abuts against the movable block and is adapted to force it against the fixed block. See illustration.



394,728. INDICATOR FOR ELECTRIC CIRCUITS.

394,905. Armature Core for Dynamo Electric Machines; W. S. Belding, Chicago, Ill. Application filed Jan. 24, 1888. The object of the invention is to produce a blank with which may be built interlocking segments or sections of an armature, which sections when combined shall form an armature which is symmetrical throughout. The blank is cut in thin strips from sheets of material, and a number of them are united to form a section or segment of the armature, and two or more sections are interlocked at their meeting ends to constitute the armature.

394,914. Telephone Exchange System; George F. Durant, of St. Louis, Mo., and Henry L. Bailey, of Brooklyn, N. Y.; Cornelia A. Bailey, administratrix of Henry L. Bailey, deceased. Application filed May 10, 1888. Invention consists in providing operators at the central station of a telephone exchange system having equalized lines and bell magnets, with an arrangement of signaling circuits and circuit controllers, that the operators at the central station may know when any line is in use or not left in its normal condition.

394,925. Electric Push Button; Andrew J. Hoyt, Philadelphia, Pa., Assignor of one-half to F. Hoyt, of same place. Application filed May 17, 1888. The object of the invention is to so construct an electric push button that the signal will only be given when the button is being depressed, the signal ceasing when the button has reached the limit of its inward movement and failing to sound on the backward movement of the button.

394,946. Electric Circuit; John B. Wood, Montreal, Canada. Application filed May 21, 1887. This invention has reference to certain improvements in the circuits used in telephoning and telegraphing, by which, without the use of a central office, electrical connections may be made between any two of the stations connected therewith; that is to say, in the same circuit, and disconnected at will without calling any other station or location than the one desired, which will enable a large number of instruments (each instrument being in a different location) to be attached upon the same circuit, and any one instrument at any station or location may be connected with any other instrument at any other station or location in the same circuit at will.

THE ELECTRICAL WORLD

A Weekly Review of Current Progress in Electricity and its Practical Applications

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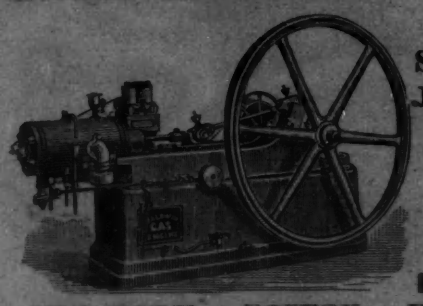

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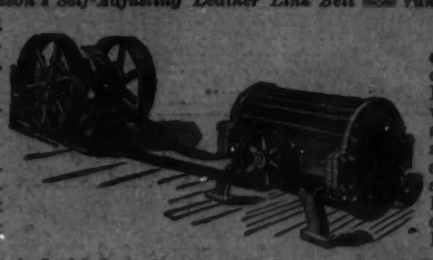

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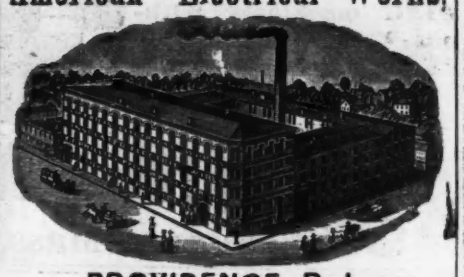

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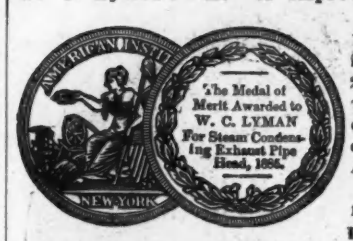

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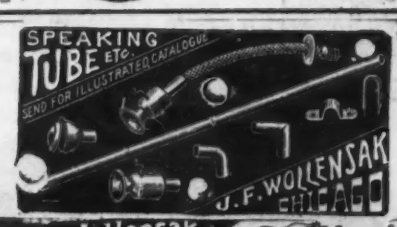

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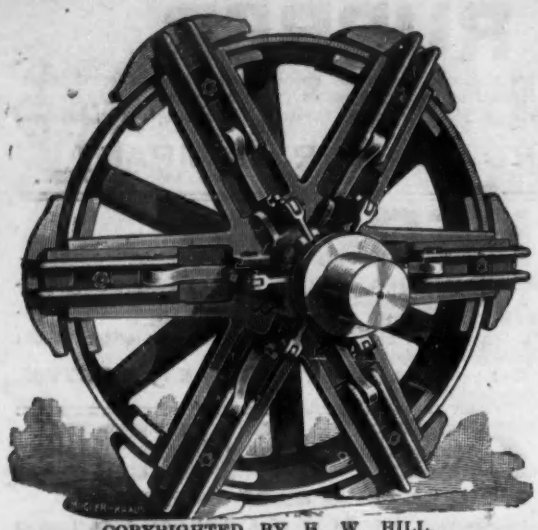

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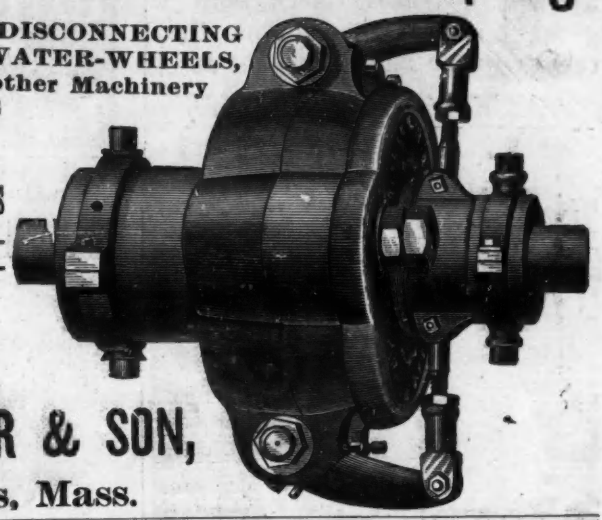

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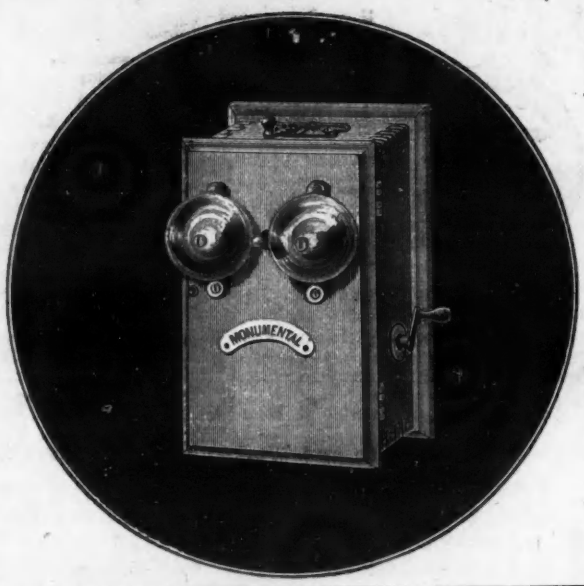

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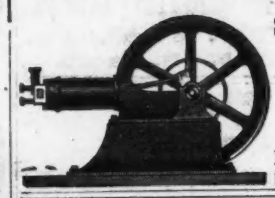

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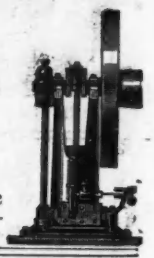

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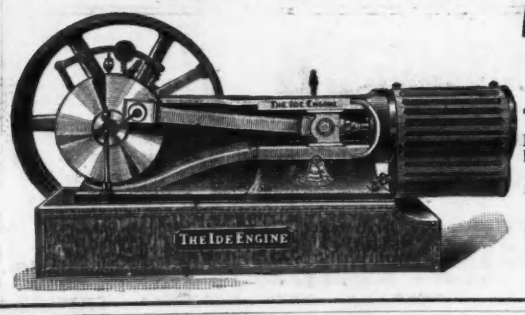

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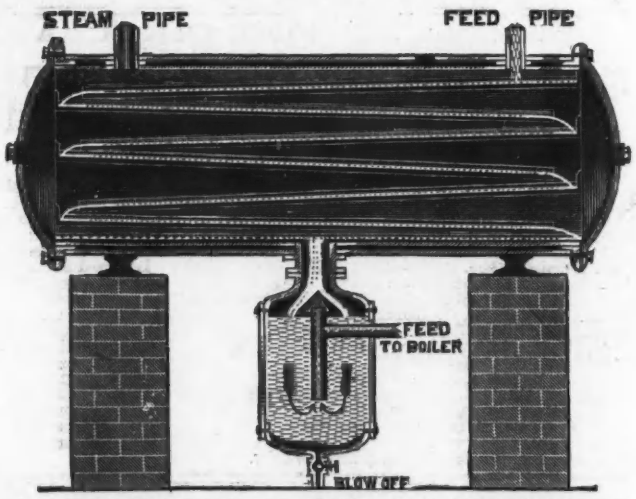

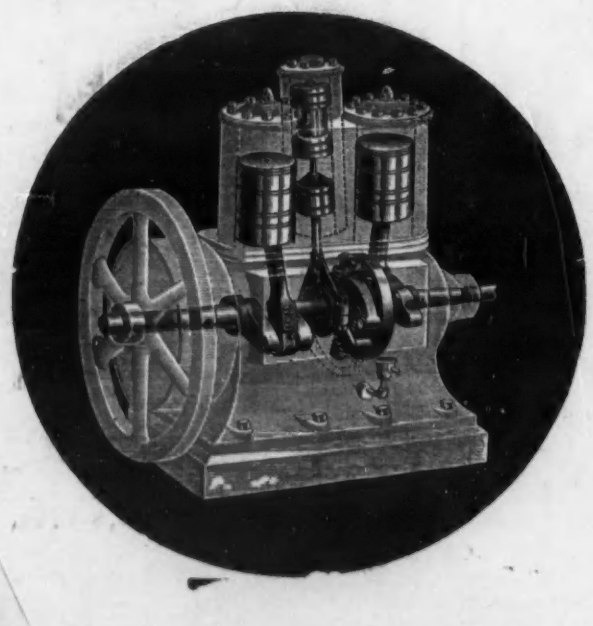

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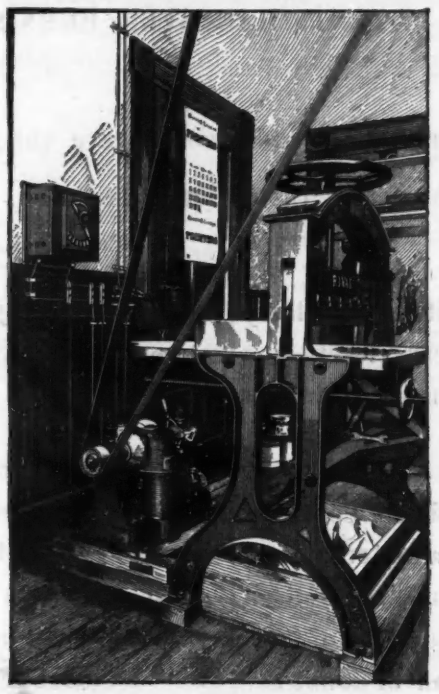
ELECTRICAL TRANSMISSION OF POWER.

MOTORS

from one-half horse-power upward.



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Constant under all variations in load.

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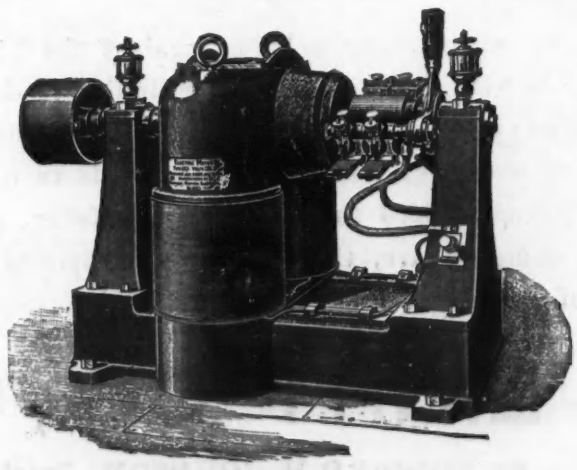
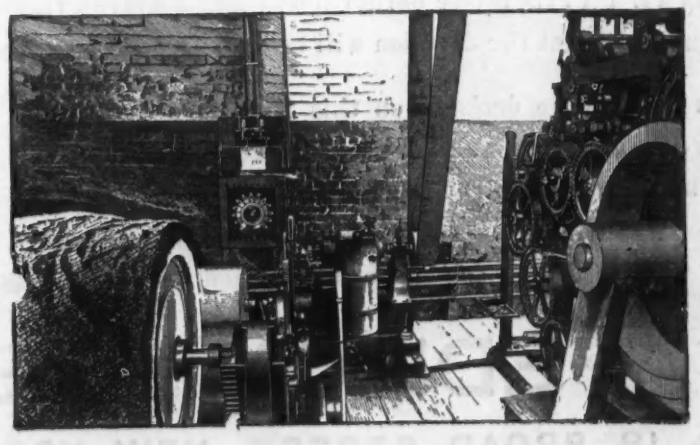


Thomson-Houston Electric Motor.



Type revolving, double cylinder, Hoe perfecting, printing press operated by Thomson-Houston Motor. *Daily News* office, Salem, Mass.

EDISON ELECTRIC LIGHT COMPANY.

So much has been said in relation to PATENT DECISIONS, and we have been so urgently and repeatedly requested to refute the misstatements and misrepresentations of electrical companies, who have been in the habit of rushing into the press upon any and every slight pretext, that we have decided to give a brief synopsis of the facts. In the preliminary movements of the legal campaign which we have inaugurated for the protection of our patents, the defendants have pursued only dilatory and evasive tactics, notwithstanding their pretense of anxiety to have the fight conducted in an open field and the issue determined on its merits. The potent fact still remains that NO ONE OF OUR THREE HUNDRED PATENTS HAS EVER BEEN SET ASIDE OR ADJUDICATED IN ANY COURT OF LAW IN THE UNITED STATES.

The decisions actually rendered in the courts of Europe and America are thirteen in number, of which ELEVEN HAVE BEEN IN FAVOR OF THE EDISON PATENTS and only two against them, and these two, as will be shown, were purely of a preliminary character.

FIRST.—The fundamental or "filament" patent on the lamp has been sustained six times in Germany, after a very closely and hotly contested litigation, and in the face of the most stringent patent laws in the world.

SECOND.—Some two years ago the English Edison Company brought suit against Woodhouse & Rawson, and after a bitter controversy in the English Court, Mr. Justice Butt sustained the Edison filament patent, and his decision, based as it was on a question of fact, has now become famous as establishing beyond question of doubt the priority of Edison's right to the only commercially practicable incandescent lamp, viz., a "FILAMENT OF HIGH RESISTANCE."

THIRD.—The defendants in the above-mentioned suits appealed from the decision of Mr. Justice Butt, but his decision was affirmed by the Appellate Court.

FOURTH.—A suit was brought by the English Edison Company upon a patent which describes a process of building up carbon conductors by electro-chemical action. This suit was decided in favor of the English Edison Company, but the process is not now used in the manufacture of its lamp by the Edison Company in this country.

FIFTH.—The recent decision of Judge Kay against the English Edison Company involved the "filament" patent, the same as was covered by the suits mentioned in the second and third paragraphs above, upon which patent all previous decisions, both in England and Germany, have been in favor of Edison. The adverse decision of Judge Kay will be immediately appealed from, and as the Appellate Court is the same which has already decided IN EDISON'S FAVOR ON THE SAME PATENT (see paragraphs 2 and 3 above), there can be little doubt but that the decision will be again in Edison's favor.

In this country no decision on this important patent has ever been rendered, and as the English decision could not in any way affect the patent in this country, the recent attempts, through the medium of newspaper interviews and correspondence and otherwise to give the impression that ANY Edison American patent is invalidated in consequence of Judge Kay's decision bear the stamp of intentional misrepresentation.

SIXTH.—In the suits brought by us against the United States Electric Light Company in the New York Courts, the defendants set up a plea that certain foreign patents upon the same invention had expired, and that, in consequence, the American patent is void. We demurred to this plea, but Judge Wallace decided against us, and the defendants will now be compelled to defend themselves against our next and more serious onslaught, in which we propose to prove that the foreign patents HAVE NOT EXPIRED. Even should we fail in establishing this question of fact, we shall then be prepared to show that, by a proper and equitable interpretation of the statute, the expiration of a foreign patent does not invalidate the American patent. This latter we hold to be an absolutely impregnable position, constructed of the material essence of all equitable law and common sense. It will be seen from the foregoing that, instead of having won the twenty-six suits, as is so audaciously claimed by the unscrupulous officers of the United States Company, they have merely won an incidental plea, which gives them a foothold upon the battle-field. The real fight has as yet not begun.

SEVENTH.—In the suits brought by us against the Westinghouse Company, in Trenton, N. J., they moved to dismiss our bill on the ground that the old Edison Company (prior to its consolidation with the Isolated Company), in whose name the suits were filed, has, by means of that consolidation, not sufficient life to prosecute these suits. Judge Wales decided this point in our favor, and therefore the Westinghouse people are now compelled to meet the issue squarely.

EIGHTH.—In the suits brought by us against the Thomson-Houston Company, in New Haven, Conn., after similar tactics were pursued, the claim was there set up that the new Edison Company, in whose name the suits were filed, had not sufficient title to maintain them. Judge Shipman decided this point in our favor, and the Thomson-Houston Company are, therefore, now compelled to answer the charge of infringement.

EDISON ELECTRIC LIGHT CO.,

16 & 18 BROAD STREET, NEW YORK.

By EDWARD H. JOHNSON, President.

H. B. COBB, President. J. NEWLIN GAWTHROP, Vice-President. C. F. THOMAS, Secretary and Treasurer.

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HIGH EFFICIENCY. LONG LIFE. NO BLACKENING.

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The success of the Alternating Current system of Electric Lighting is demonstrated beyond question.

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This Company's Meter measures the whole current by a positive mechanical movement.

It registers directly in lamp hours and indicates by dials like a gas meter. It is not affected by temperature or local conditions.

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Highly efficient. Have no commutators or brushes, and can be started, regulated and reversed without breaking a connection.

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NO REVERSING. NO WATER. NO NOISE. NO SPARK.

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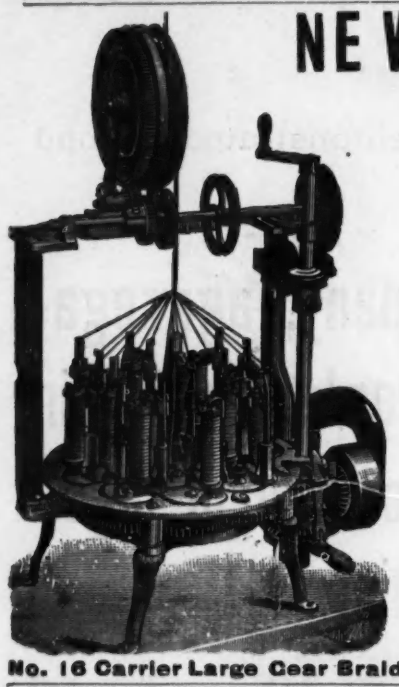

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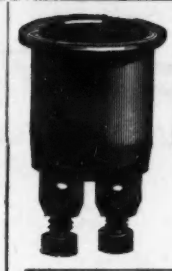
For Silk Worsted and Cotton Braid

No. 16 Carrier Large Gear Braider. FINE CASTINGS A SPECIALTY.



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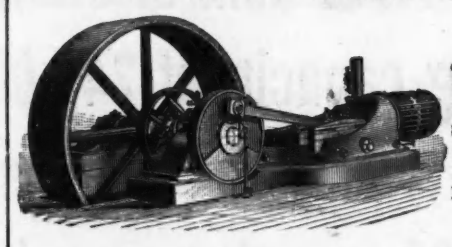
NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

IN USE OVER 1,000. 25 TO 1,000 H. P.



These Engines are the combined result of long experience with Automatic cut-off regulation and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-Contained Automatic Cut-off Engines, 12 to 100 H. P., for driving Dynamo Machines a Specialty. Illustrated Circulars with various data as to practical Steam Engine Construction and performance free by mail.

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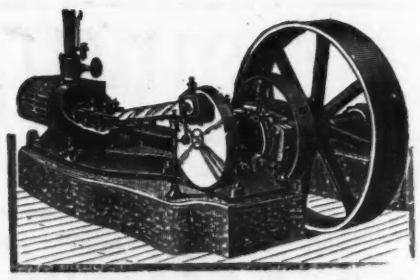

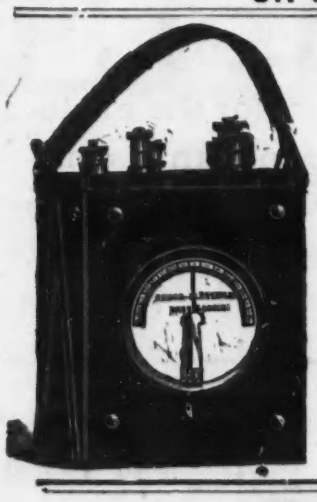

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GOODS OF ALL KINDS BY KRUEGER'S PATENT.

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"I earnestly hope that you may meet with abundant success 'out in the world,' and be treated as well as you deserve. Very truly yours, M. V. MONTGOMERY, *Commissioner*."

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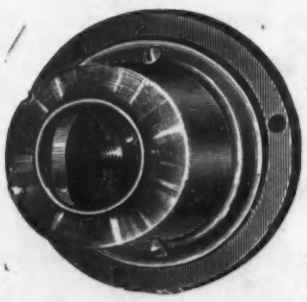

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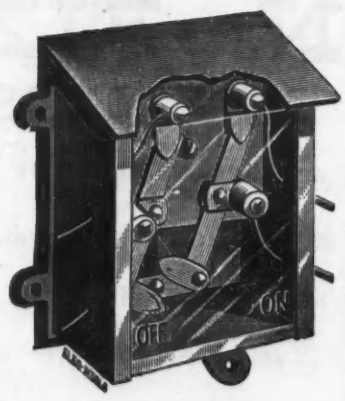

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The attention of **Electric Companies** is called to this **celebrated water wheel** as particularly adapted to their use, on account of its **remarkably steady motion, high speed** and **great efficiency, and large capacity** for its **diameter**, being **double** the **power** of most **wheels** of **same diameter.** It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent. of useful effect **guaranteed.**

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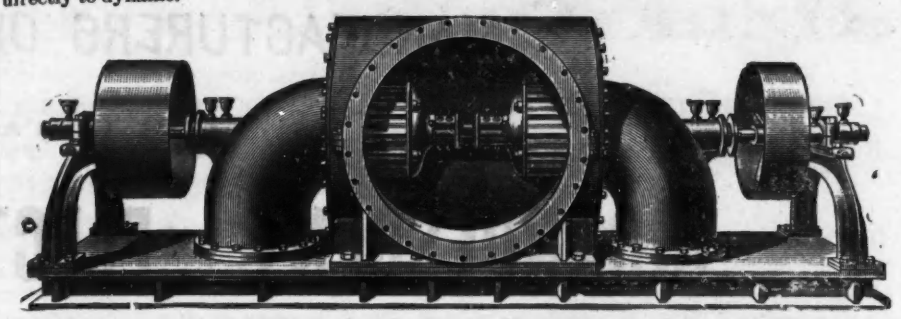

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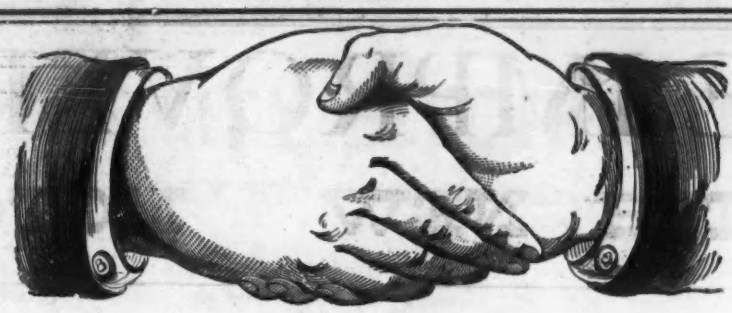

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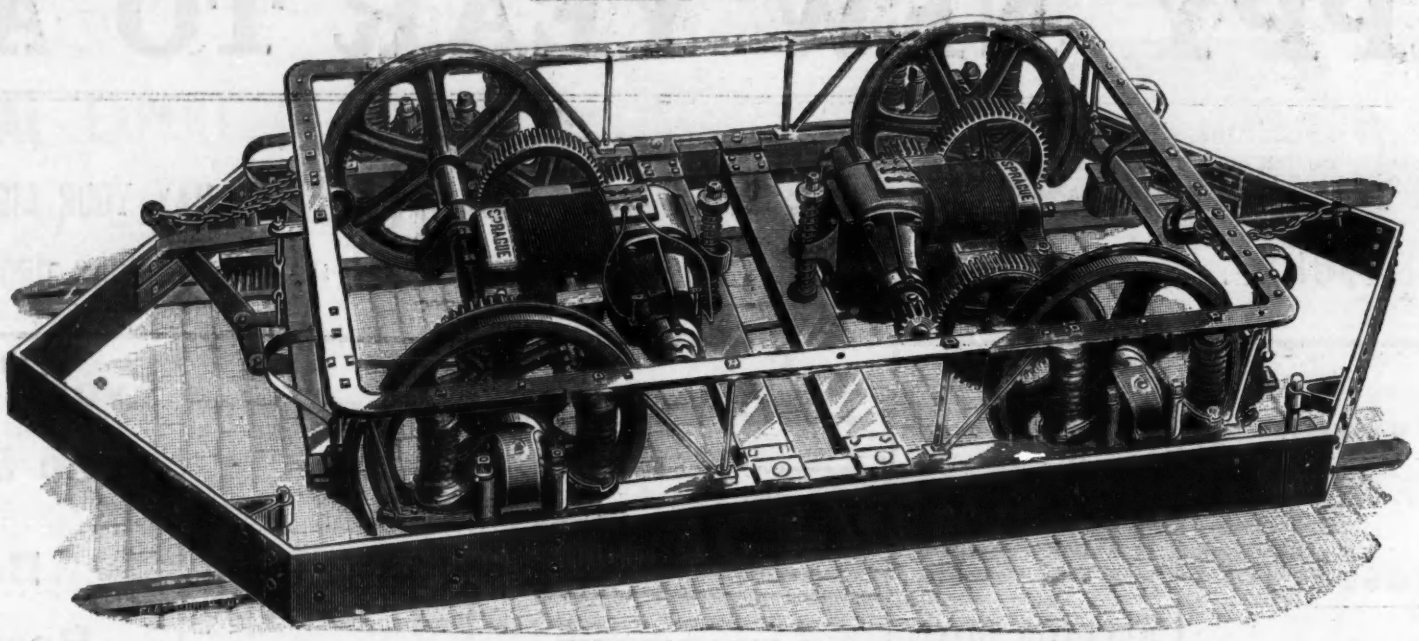

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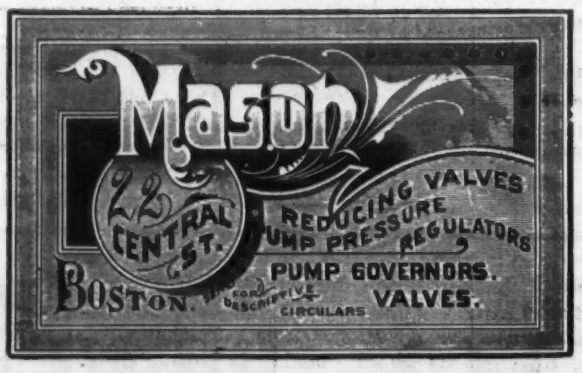

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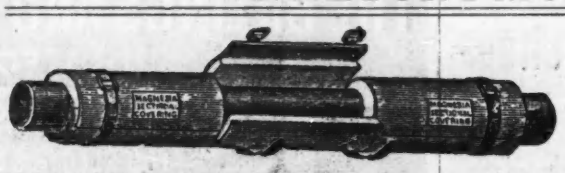

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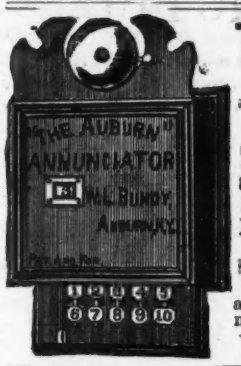

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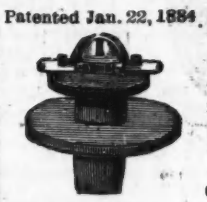

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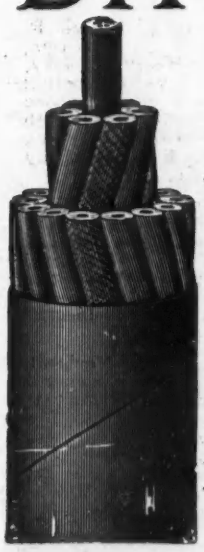

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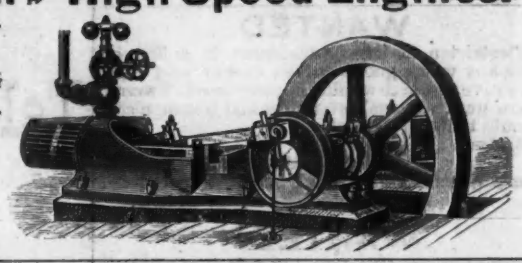

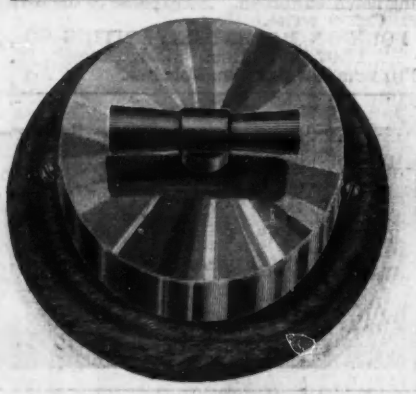

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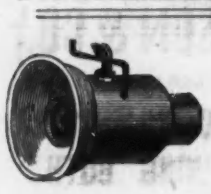

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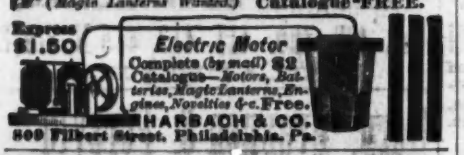
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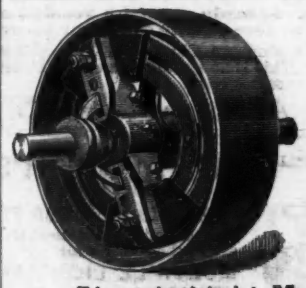

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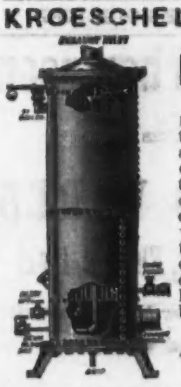

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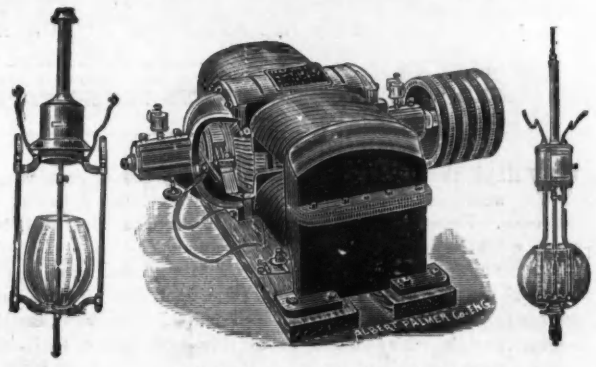
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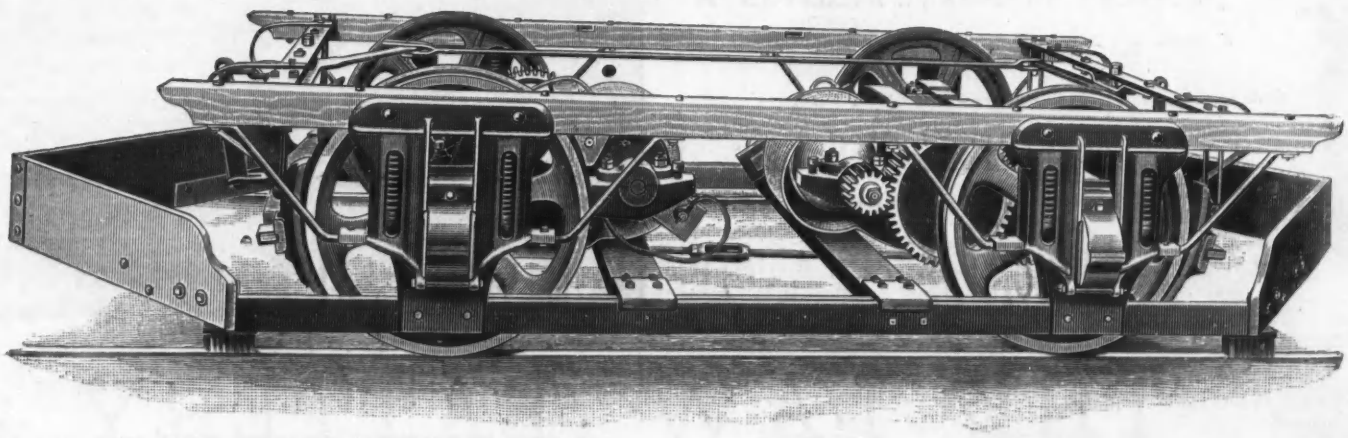

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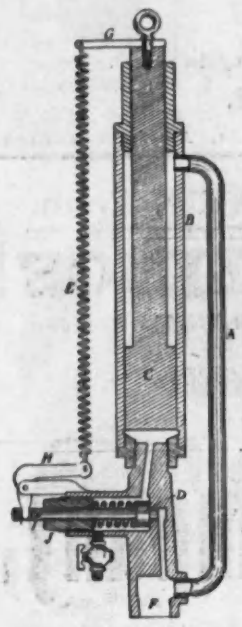

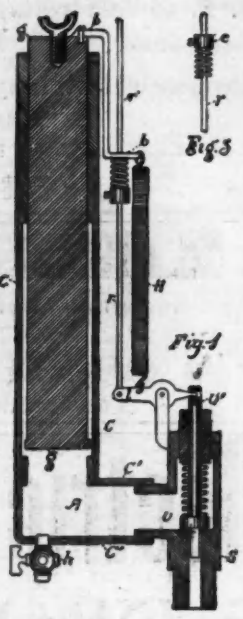

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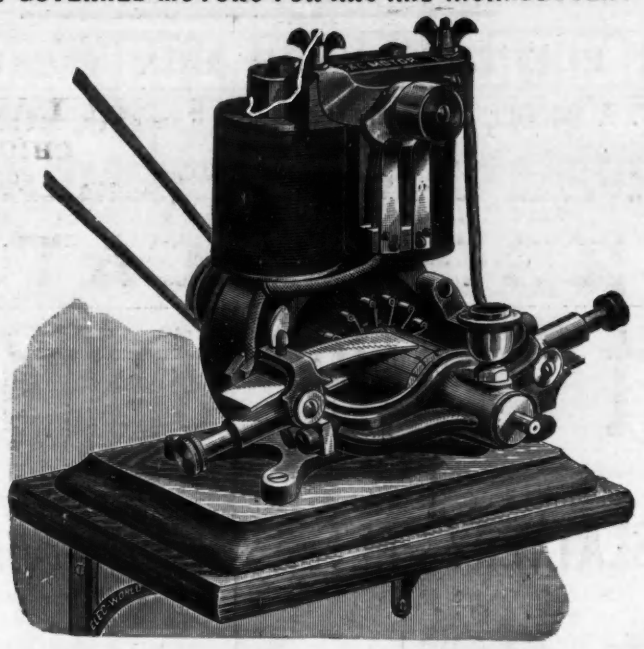

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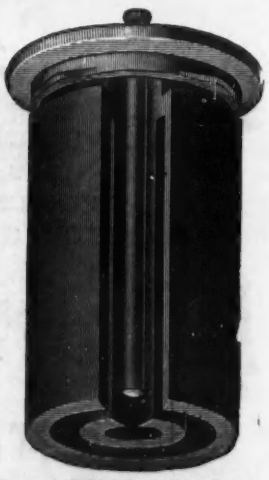

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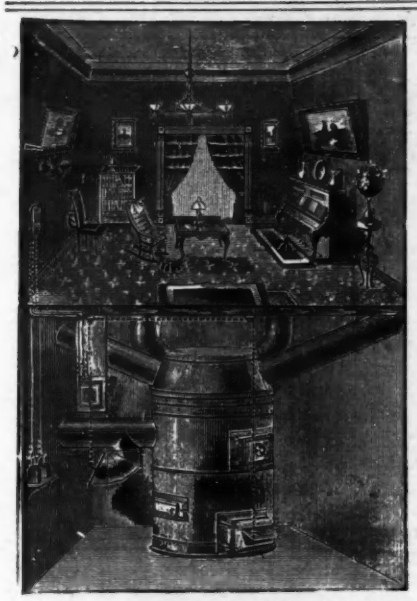

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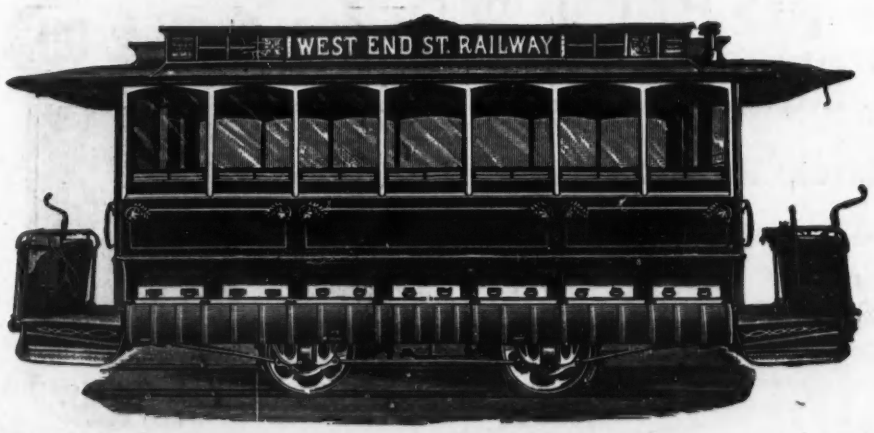

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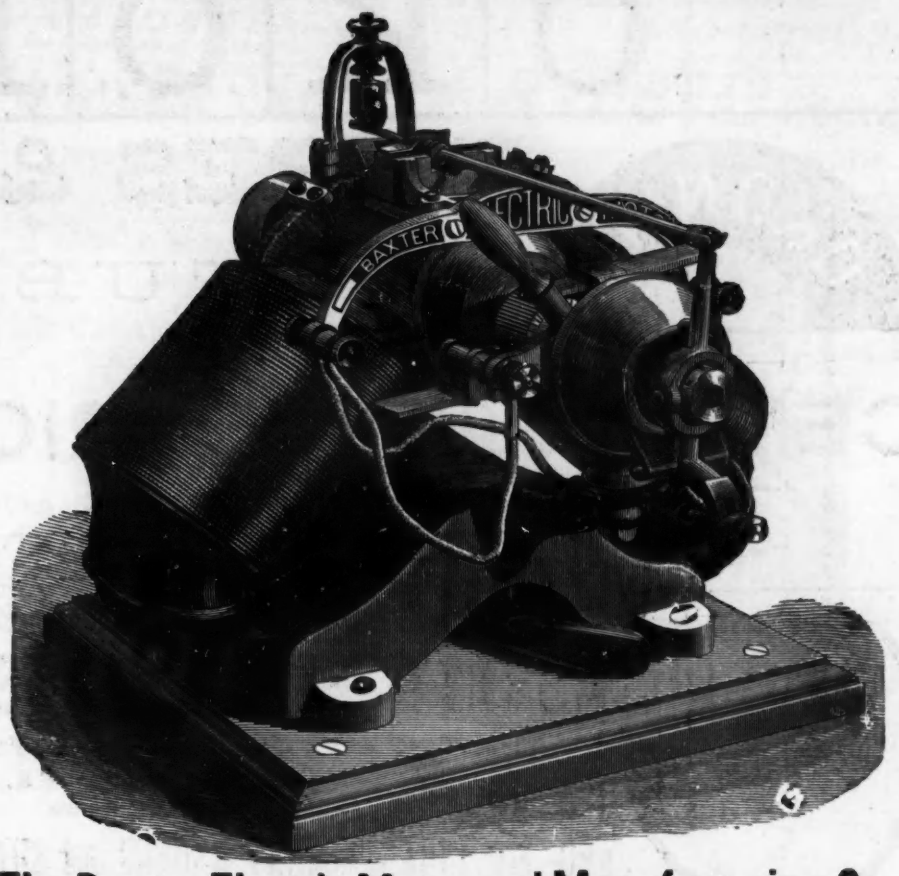

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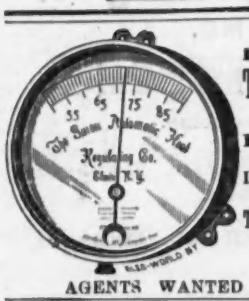

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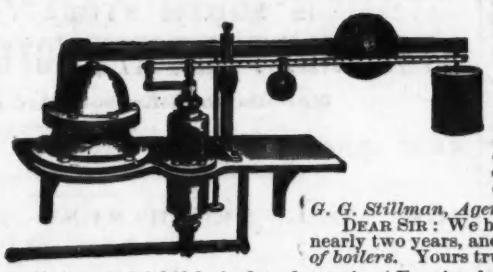

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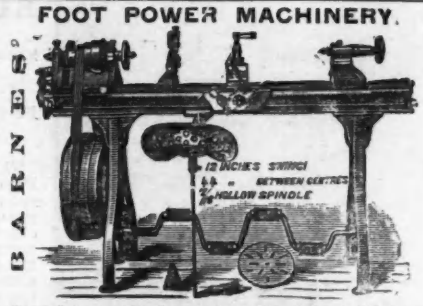

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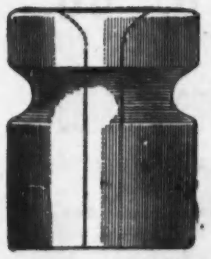

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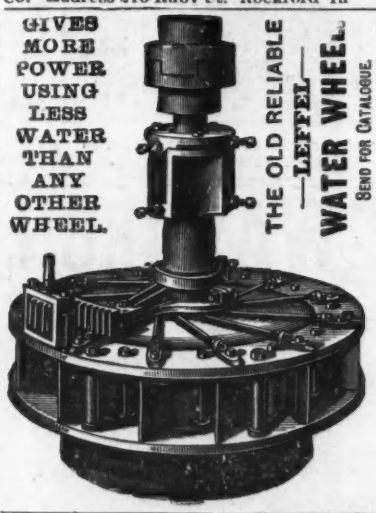

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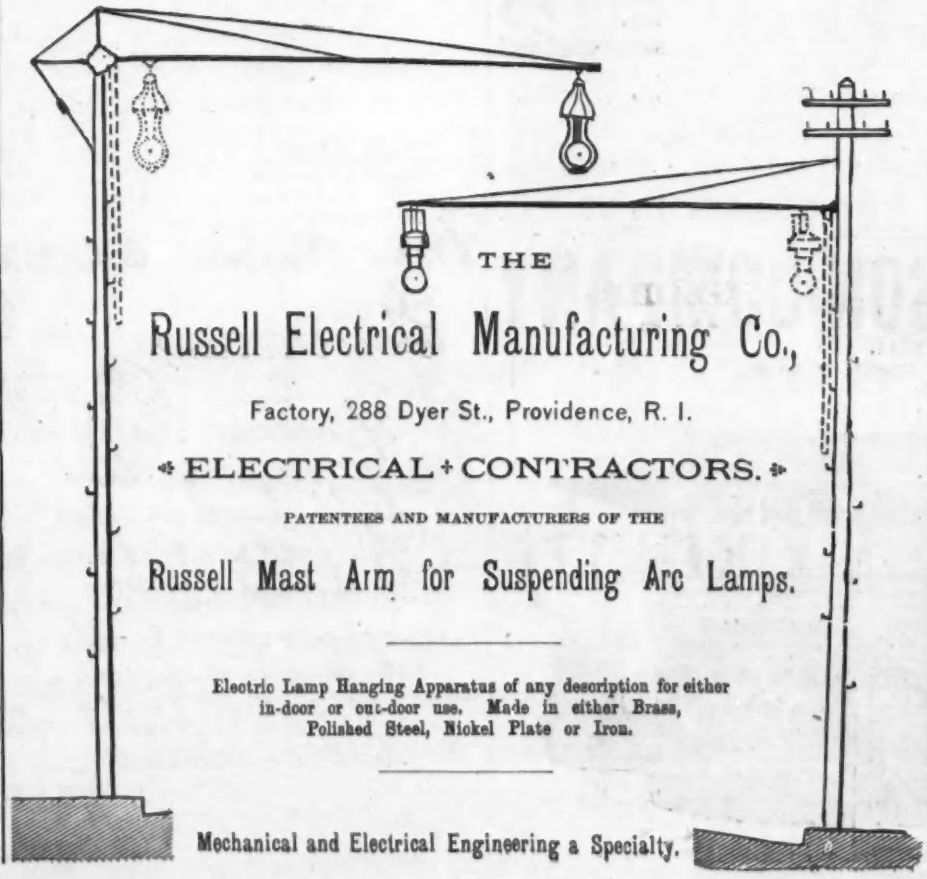

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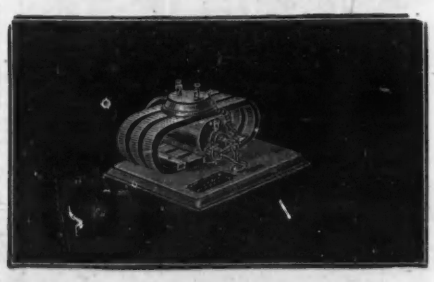

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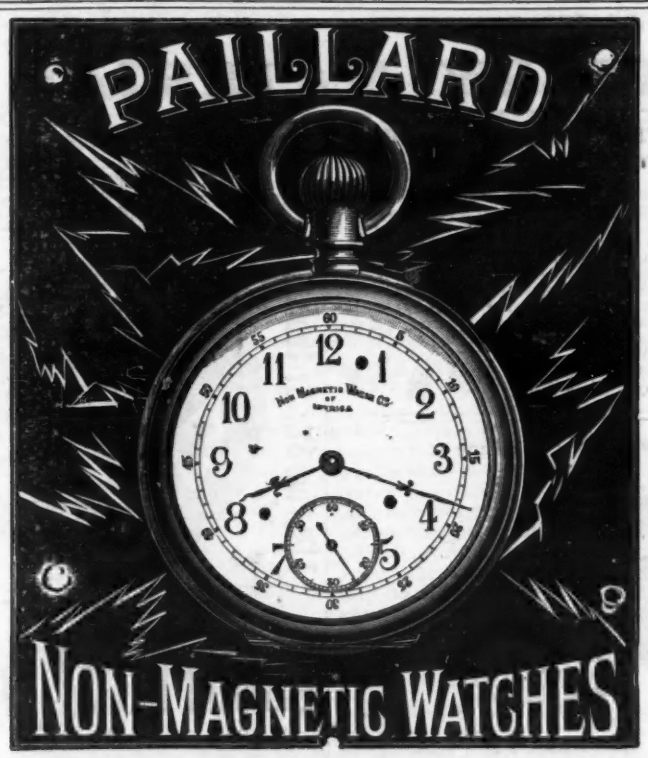

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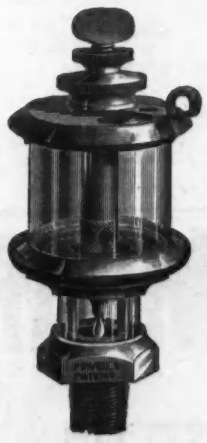

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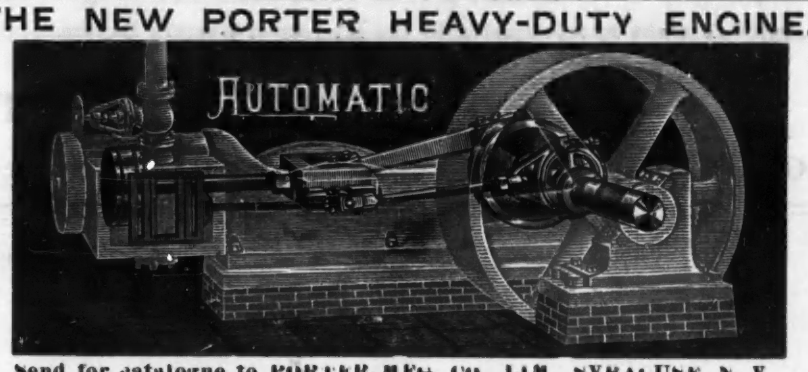

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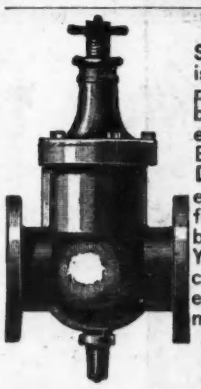

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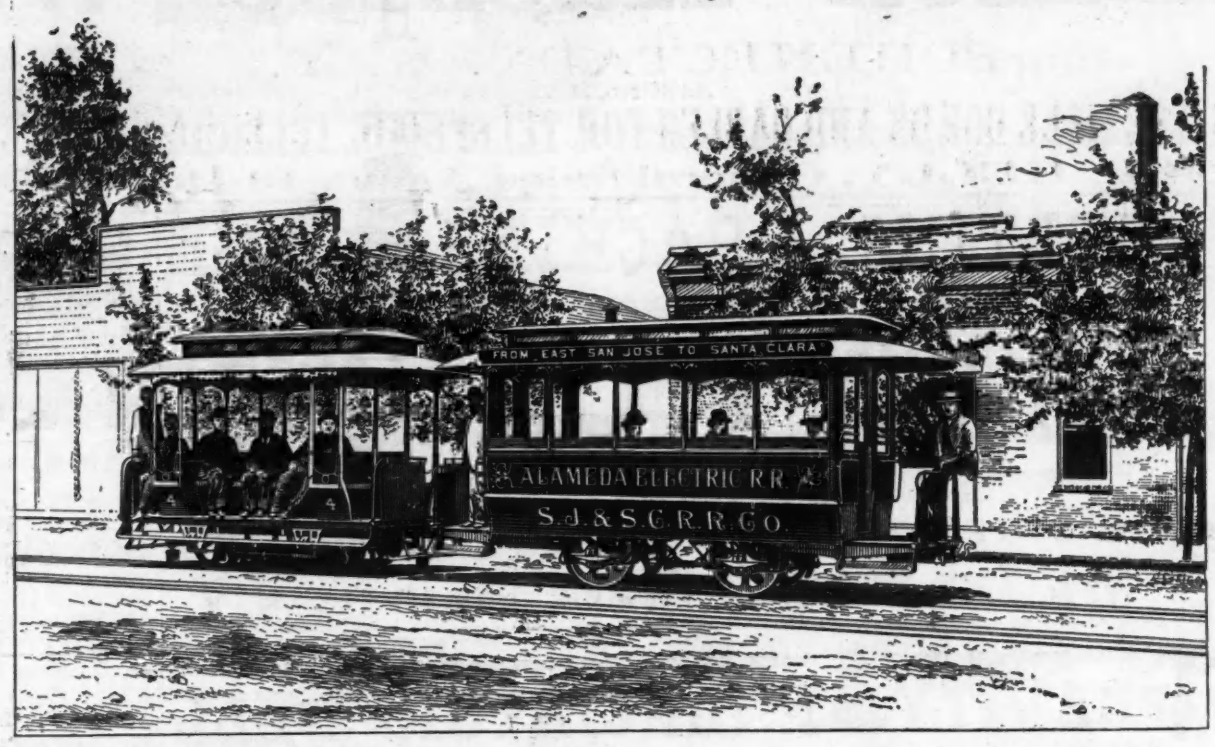

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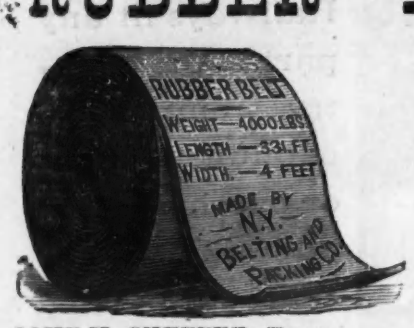

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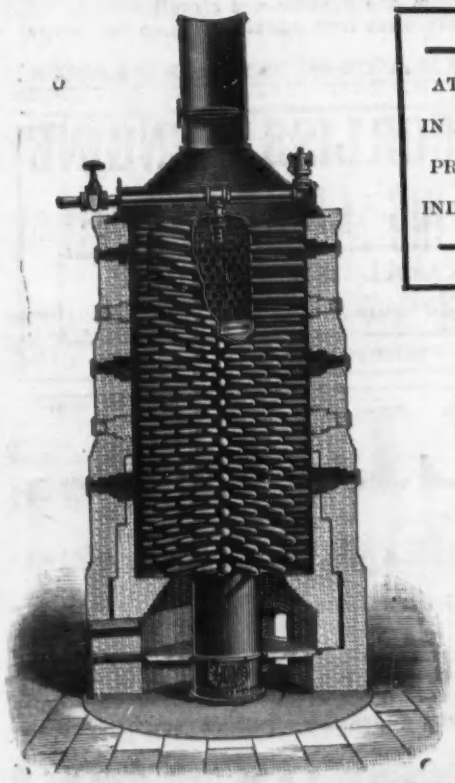

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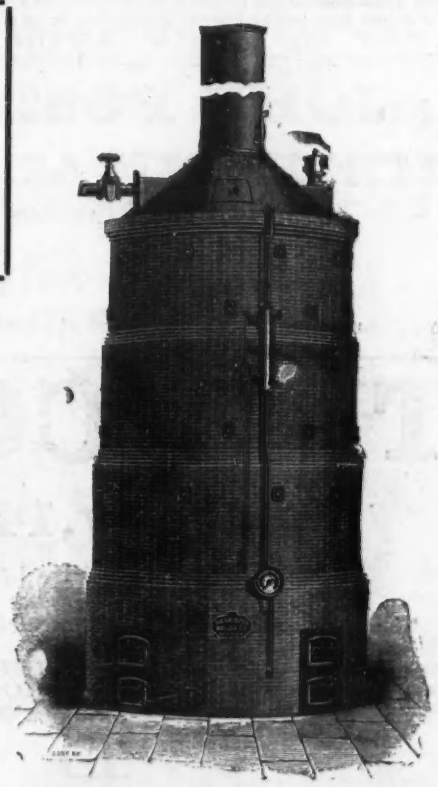

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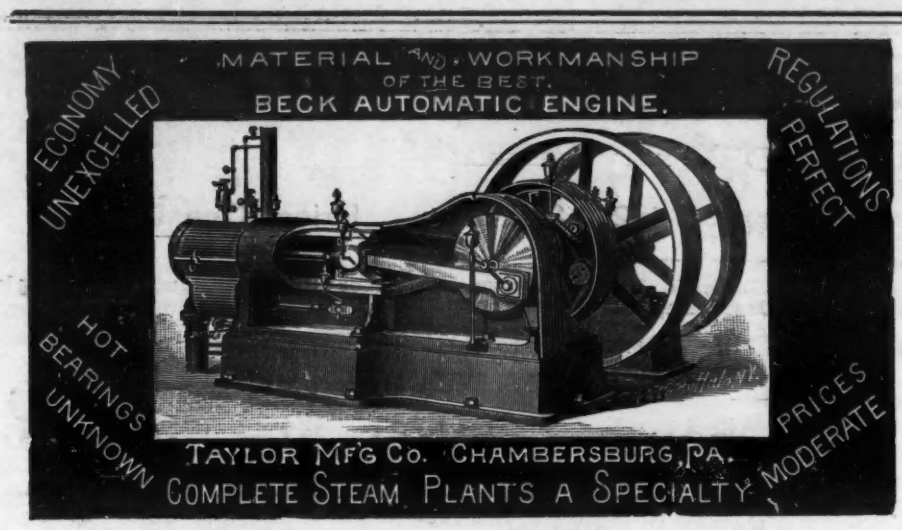

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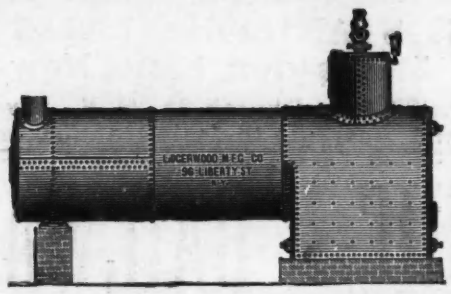
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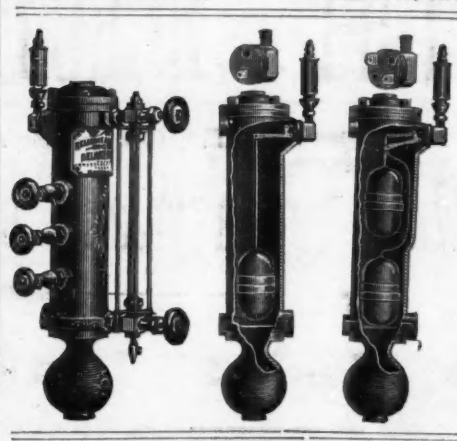

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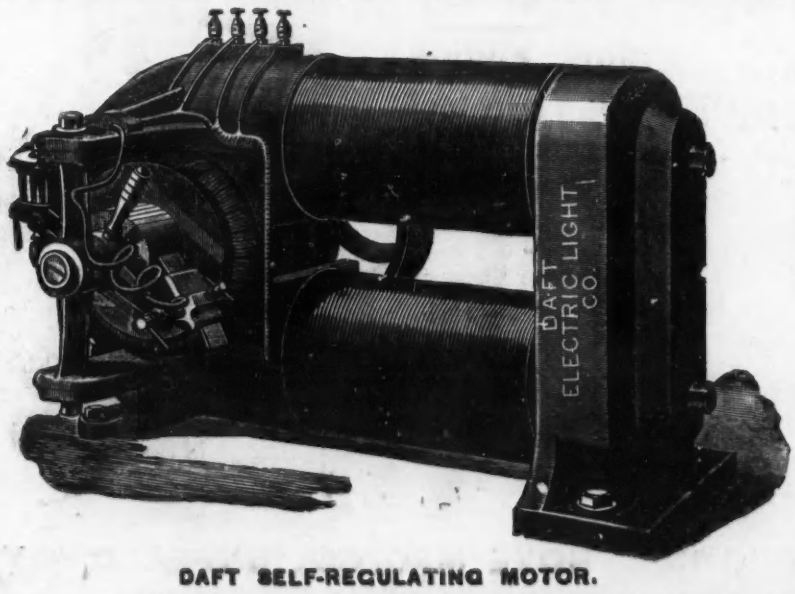

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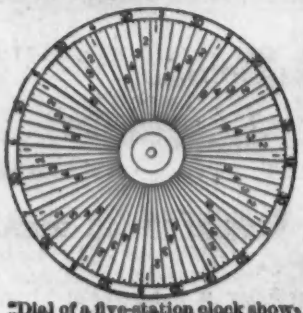

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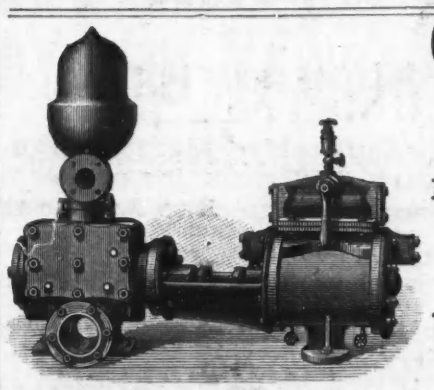

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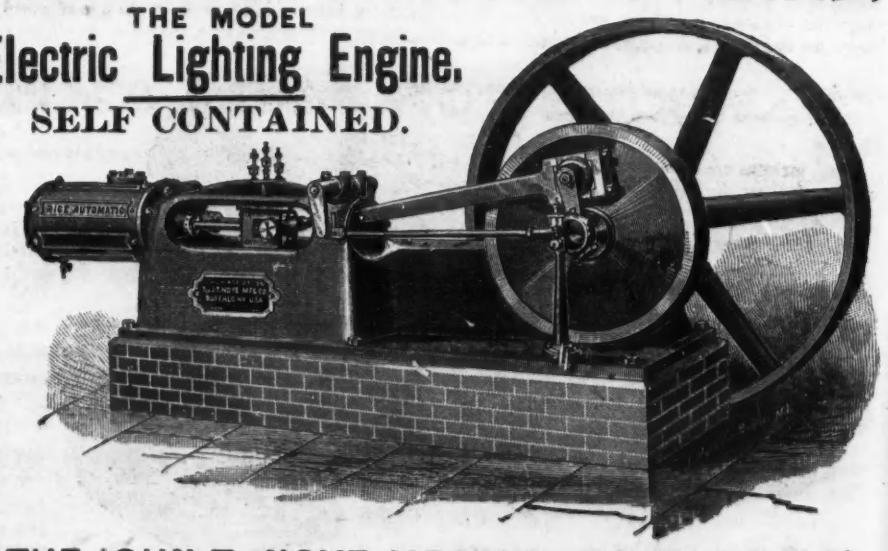

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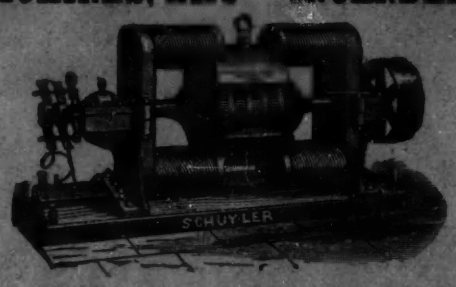

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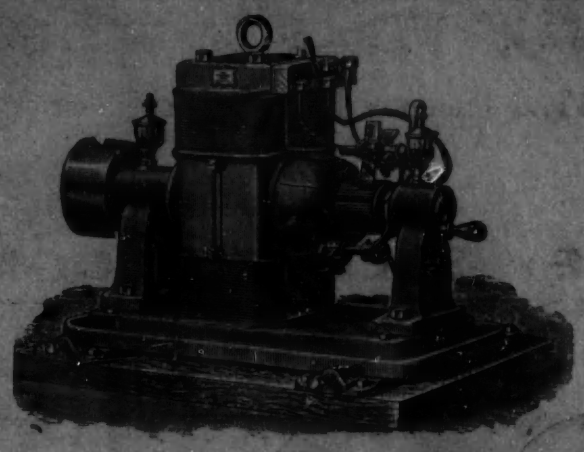

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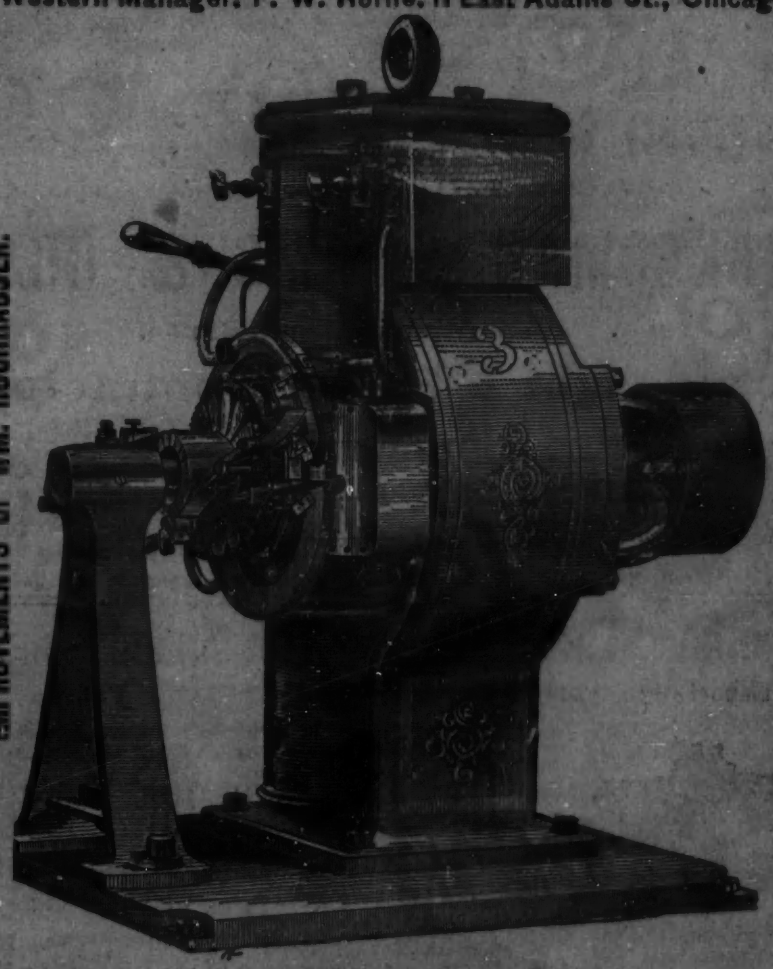

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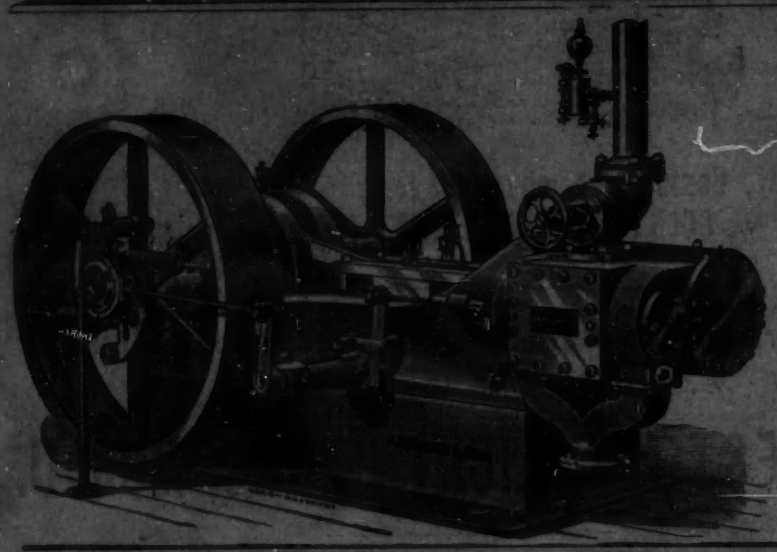

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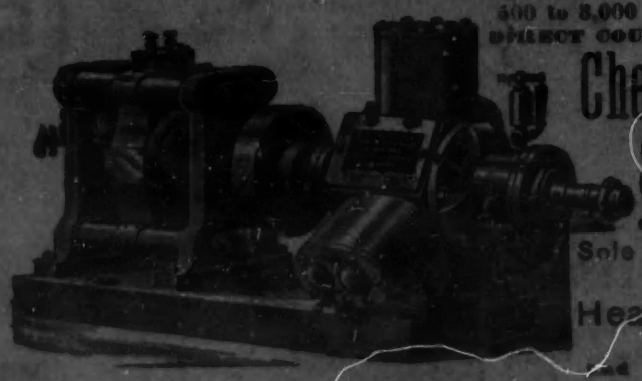

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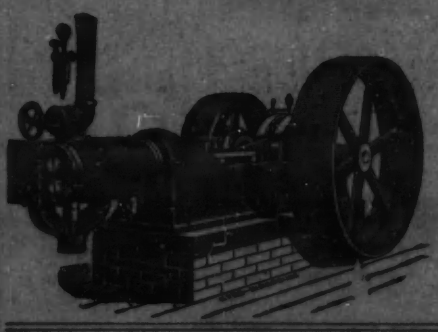

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